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PROJECT MANUAL

Willis ISD
A.R. Turner Elementary School
Classroom Expansion

01989-06-01
Willis, Texas

Volume 1
Division 00 – Division 33
Sign and Seal – July 7, 2026

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PROJECT MANUAL

Project Name:	A.R. Turner Elementary School Classroom Expansion		
Client Name:	Willis ISD	Location:	Willis, Texas
Project Number:	01989-06-01	Date:	July 7, 2026

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SECTION 001119
REQUEST FOR COMPETITIVE SEALED PROPOSALS

1.01 COMPETITIVE SEALED PROPOSALS

A. Willis Independent School District is requesting competitive sealed proposals for **A.R. Turner Elementary School Classroom Expansion** project**.** Proposals will be received until **3:00 PM CST on Thursday, July 30, 2026** and will be submitted electronically through the Willis ISD online bid portal at https://willisisd.ionwave.net/login.aspx.

B. A pre-proposal conference will be held on **Wednesday, July 15, 2026 at 2:30 PM CST** at the **Willis ISD Central Office** located at **612 N. Campbell Street, Willis, Texas 77378**. Optional site visit immediately following the pre-proposal conference.

C. Proposals will be publicly opened electronically through the Ion Wave online bidding system at the date and time specified in the solicitation. The virtual public bid opening will be conducted via Ion Wave, where the names of the proposers will be publicly announced.

D. Electronic Documents (.pdf) may be downloaded from the Willis ISD online bid portal (https://willisisd.ionwave.net/login.aspx) and the website of Huckabee & Associates (https://moregroup-inc.com/construction). Printing services will be the responsibility of the contractor.

E. All contractor questions and substitution requests must be submitted through the Willis ISD online bid portal and by email (to matt.gvist@huckabee-inc.com) no later than **3:00 PM CST** on **Monday, July 20, 2026**. Addenda will be published on the website of Huckabee & Associates (https://moregroup-inc.com/construction) and through the Willis ISD online bid portal (https://willisisd.ionwave.net/login.aspx). No addenda will be mailed or faxed to any document holder.

F. Willis Independent School District reserves the right to accept or reject any or all bids, to waive any formalities and irregularities in the bids received, and to accept the offer most advantageous to the District.

END OF SECTION

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SECTION 003132
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 UES, report number H260669, dated June 4, 2026.

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

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GEOTECHNICAL ENGINEERING REPORT

A.R. TURNER ELEMENTARY SCHOOL ADDITION

10575 Highway 75 North
Willis, Texas 77378
UES Project No. H260669
June 4, 2026

Prepared for:

WILLIS ISD
204 West Rogers Street
Willis, Texas 77378
Attention: Gabrielle Maxwell

Prepared by:

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UES
15811 Tuckerton Road
Houston, Texas, 77095
713.360.0460 | TeamUES.com
TBPELS Firm No. 813

June 4, 2026

Willis ISD
Client Address
Willis, Texas 77378

Attention: Gabrielle Maxwell

Re: Geotechnical Engineering Report
A.R. Turner Elementary School Addition
10575 Highway 75 North
Willis, Texas 77378
UES Project No. H260669

Willis ISD:

UES has performed a geotechnical exploration for the project referenced above. This study was authorized by Kimberley James with Willis ISD on February 26, 2026, via a Professional Service Agreement (PO# 26004238, dated March 03, 2026), and performed in accordance with UES Proposal No. 113770-Rev dated February 12, 2026.

The results of this exploration, together with our recommendations, are presented in the accompanying report, an electronic copy of which is being transmitted herewith.

UES appreciates the opportunity to be of service on this project. If we can be of further assistance, such as providing materials testing services during construction, please contact our office.

Sincerely,

STATE OF TEXAS
DURAISAMY S. SARAVANATHIIBAN
123650
LICENSED
PROFESSIONAL ENGINEER

06/04/2026

Victor Guevara Jr., E.I.T.
Staff Geotechnical Engineer

Duraisamy S. (Roy) Saravanathiiban, Ph.D., P.E.
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1.0 INTRODUCTION

Purpose and Scope. The purpose of this geotechnical study was to evaluate some of the physical and engineering properties of subsurface materials at selected locations on the subject site to develop geotechnical engineering design parameters and recommendations for the proposed project. To accomplish this, the scope of this study included field exploration consisting of drilling test borings and collecting samples of the subsurface materials, performing laboratory testing on selected samples obtained during the field exploration, performing engineering analysis and evaluation of the subsurface conditions with respect to the project characteristics, and development of geotechnical recommendations suitable for the proposed project. The scope of services did not include an environmental assessment of the site.

Limitations. Recommendations provided in this report were developed from information obtained in test borings depicting subsurface conditions only at the specific boring locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from those observed at the boring locations, and subsurface conditions at boring locations may vary at different times of the year. The scope of work may not fully define the variability of subsurface materials and conditions that are present on the site. The nature and extent of variations between borings may not become evident until construction. If significant variations then appear evident, our office should be contacted to re-evaluate our recommendations after performing on-site observations and possibly other tests.

Project Location. The project is located at 10575 Highway 75 North in Willis, Texas. The general location and orientation of the site are provided in Appendix A – Project Location Diagram.

Project Description. The project consists of constructing a proposed 14,000 square foot, single-story school building addition to an existing school building. We understand that the existing building is supported on underreamed drilled piers.

Loading Information. Based on information provided by the client, we understand that the maximum sustained concentrated loads for the proposed building addition will be less than 100 kips. *Any change in the structural loads should be brought to our attention to review the design and assess the suitability of the recommendations provided.*

Site Grading. The site grading plan was not available at the time of writing this report. Our recommendations provided herein are on the basis that cuts and fills of less than 2 feet will be required to bring the site to grade. When the site grading plan is available, we should be notified and allowed to review the site grading plan to assess and modify our recommendations, as necessary.

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2.0 SITE CONDITIONS

Review of Aerial Images. Review of aerial images available from Google Earth™ indicate that the site was previously developed with multiple building structures and the buildings were demolished and removed from the site in the past. In addition, earthwork and a sidewalk were noted within the project site. Therefore, we would expect surficial disturbance of site soils. Our review revealed no obvious areas of significant cutting or filling on-site. Possible fill recommendations are provided in Section 6.1.2. Due to the intermittent nature and relatively low resolution of aerial photographs, as well as lack of provided information regarding the past land use of the site, our review should not be interpreted as eliminating the possibility of past activities on site which could detrimentally affect future construction. No additional information was provided for this study regarding previous site activities or development.

Potential Existing Foundations. It is not known whether the foundations supporting the former structures at the site were removed and backfilled or abandoned in-place. Demolition considerations for the potential existing foundations are provided in Section 6.1.1.

Topography. A United States Geological Survey (USGS) topographic map of the site is provided in Appendix E - USGS Topographic Map. The map indicates the site is relatively flat.

3.0 FIELD EXPLORATION

Test Borings. The field exploration for this project included performing a total of 3 test borings as summarized in the following table. Boring depths were measured from the existing ground surface at the respective boring location at time of the field exploration.

Summary of Boring Depths and Locations		
Boring Identification	**Depth, feet**	**Location**
B-1 to B-3	25	Building Addition Area

Test borings were advanced using standard rotary drilling equipment at the approximate locations as shown in Appendix B - Boring Location Diagram. The boring locations were not surveyed. UES located the borings in the field using a hand-held GPS unit with lateral accuracy of ± 20 ft. Therefore, the boring locations should be considered approximate.

Relatively Undisturbed Soil Sampling. Cohesive soil samples were generally obtained using Shelby tube samplers in general accordance with ASTM D1587. The Shelby tube sampler consists of a thin- or thick-walled steel tube with a sharp cutting edge connected to a head equipped with a ball valve threaded for rod connection. The tube is pushed into the undisturbed soils by the hydraulic pulldown of the drilling rig. The soil specimens were extruded from the tube in the field, logged, tested for consistency using a hand

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penetrometer, sealed and packaged to maintain "in situ" moisture content. The consistency of relatively undisturbed soil samples was evaluated in the field using a calibrated hand penetrometer. In this test a 0.25-inch diameter piston is pushed into the undisturbed sample at a constant rate to a depth of 0.25-inch. The results of these tests are tabulated at the respective sample depths on the boring logs. When the capacity of the penetrometer is exceeded, the value is tabulated as 4.5+. One representative portion of each sample was sealed in a plastic bag for use in future visual evaluation and possible testing in the laboratory. The subsurface samples will be retained in the laboratory for at least 14 days and then discarded unless the Client requests otherwise.

Disturbed Soil Sampling. Disturbed soil samples were generally obtained using split-barrel sampling procedures in general accordance with ASTM D1586. In the split-barrel procedure, a disturbed sample is obtained in a standard 2-inch outside diameter (OD) split barrel sampling spoon driven 18 inches into the ground using a 140-pound (lb) hammer falling freely 30 inches. The number of blows for the last 12 inches of a standard 18-inch penetration is recorded as the Standard Penetration Test resistance (N-value). The N-values are recorded on the boring logs at the depth of sampling. Samples were sealed and returned to the laboratory for further evaluation and possible testing. The subsurface samples will be retained in the laboratory for at least 14 days and then discarded unless the Client requests otherwise.

Groundwater Observations. A summary of groundwater observations is provided in Section 4.3.

Borehole Backfilling and Plugging. Upon completion of the borings, the boreholes were backfilled with on-site soil cuttings and the surface was plugged using bentonite hole plug.

4.0 SUBSURFACE CONDITIONS

4.1 Geology

Geologic Formation. Based on a review of literature and public maps in our library, as well as our experience, the project site lies within the Coastal Prairies Province of the Gulf Coastal Plains Physiographic Region of Texas and is underlain by soils common to the Willis Formation.

The Willis Formation is approximately Pliocene in age. At outcrop, the Willis Formation erosionally downcuts and locally truncates the underlying Goliad Formation, and is in turn eroded and locally onlapped by the overlying Lissie Formation. The Willis outcrop consists of cuesta-forming erosional remnants in the Houston Embayment and on the San Marcos Arch. The Willis Formation is composed of gravelly coarse sand in several upward-fining successions that are interpreted as incised valley fills overlain by transgressive deposits.

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The Willis Formation ranges in thickness from about 100 ft at outcrop to 500 ft near the coast and also thickens northeastward. The Willis dips coastward about 15 to 20 ft per mile, and is 1,000 to 2,000 ft deep at the modern shoreline. Willis fluvial systems include dip-oriented, sand-rich channel-fill facies and sand-poor interchannel areas, which grade toward the coast into shore-parallel deltaic and shore-zone sands and interdeltaic muddy bay deposits. Individual Willis sands vary widely in thickness from about 20 to 200 ft, and are separated by muds of similar thickness. Fluvial channel sands thin and become more isolated in interchannel muds southward along the central coast.

4.2 Subsurface Lithology

Stratigraphy. Descriptions of the various strata and their approximate depths and thickness per the Unified Soil Classification System (USCS) are provided on the boring logs included in Appendix B - Boring Logs. Terms and symbols used in the USCS are presented in Appendix B following the Boring Logs. A summary of the stratigraphy indicated by the borings is provided in the following table.

Generalized Subsurface Conditions (Borings B-01 to B-03)[1]			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	4 to 13	SAND	Loose to Medium Dense SILTY SAND (SM) and Loose to Medium Dense CLAYEY SAND (SC).
4 to 13	25	LEAN CLAY	Soft to Very Stiff SANDY LEAN CLAY (CL), LEAN CLAY (CL), and LEAN CLAY WITH SAND (CL).
Note: 1. Boring Termination Depth = 25 feet bgs.			

It should be noted that the depths provided in the above tables and on the boring logs are based on our Field Technician's and Engineer's interpretation of conditions believed to exist between actual samples retrieved. Therefore, information on the boring logs contains both factual and interpretive information. Lines delineating subsurface strata are approximate and the actual transition between strata may be gradual or not clearly defined. In addition, variations may occur between or beyond the boring locations.

4.3 Groundwater Observations

Groundwater Levels. Groundwater levels encountered in the borings during this study are identified in the table below. Depths referenced in this report and in the following table are measured from the existing ground surface at the respective boring location at time of the field exploration.

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Summary of Groundwater Level Observations		
Boring No.	**Depth Groundwater Initially Encountered (feet)**	**Groundwater Depth Upon Completion of Drilling (feet)**
B-01 and B-02	23	23
B-03	18	18

Long-term Groundwater Monitoring. Groundwater observations in this report are those that were present at the time the borings were drilled. The depth and amount of water encountered in an open borehole largely depends on the permeability of the soils encountered at the boring location. In relatively impervious soils, such as clayey soils, a suitable estimate of the groundwater depths generally requires long-term monitoring. Long-term monitoring of groundwater conditions via piezometers or groundwater monitoring wells was not performed during this study and was beyond the scope of this study. Long-term monitoring can reveal groundwater levels materially different than those measured in the borings.

Groundwater Fluctuations. Subsurface groundwater fluctuations can occur. Future construction activities can alter the surface and subsurface drainage characteristics of this site. Seasonal variations, temperature, land-use, proximity to water bodies, and rainfall can also influence groundwater levels. UES recommends that the contractor verifies the groundwater elevation before construction starts.

4.4 Seismic Site Classification

The Site Class assigned for seismic design considers various factors, such as the soil profile (whether it's soil or rock), shear wave velocity, and strength, averaged over a depth of 100 feet. Since the borings didn't reach depths of 100 feet, UES made determinations under the assumption that the subsurface materials beneath the borehole bottoms resembled those encountered at the termination depth. Following the guidelines outlined in Section 1613.2.2 of the 2024 International Building Code and Table 20.2-1 in the 2022 ASCE-7, UES recommends using Site Class D (stiff soil) for seismic design purposes at this location.

5.0 LABORATORY TESTING

UES performs visual classification and laboratory tests, as appropriate, to define pertinent engineering characteristics of the soils encountered. Laboratory tests are performed in general accordance with ASTM or other applicable standards. Test results are included at the respective sample depths on the boring logs or separately tabulated herewith, as appropriate. Laboratory tests and procedures performed for this geotechnical study are summarized in the following table.

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Summary of Laboratory Tests and Procedures	
Test Procedure	**Description**
ASTM D4220	Standard Practices for Preserving and Transporting Soil Samples
ASTM D2487	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D1140	Standard Test Methods for Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
ASTM D2166	Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
ASTM D4546	Standard Test Methods for One-Dimensional Swell or Settlement Potential of Cohesive Soils

6.0 RECOMMENDATIONS

6.1 Demolition Considerations and Possible Fill

As discussed in Section 2.0, existing buildings were demolished in the past within the project site.

6.1.1 Demolition

Applicability. Recommendations in this section apply to the removal of any existing foundations, utilities or pavement which may be present on this site.

General. Special care should be taken in the demolition and removal of existing floor slabs, foundations, utilities and pavements to minimize disturbance of the subgrade. Excessive disturbance of the subgrade resulting from demolition activities can have serious detrimental effects on planned foundation and paving elements.

Existing Foundations. Existing foundations are typically slabs, shallow footings, or drilled piers. If slab or shallow footings are encountered, they should be completely removed. If drilled piers are encountered, they should be cut off at an elevation at least 24 inches below proposed grade beams/footings or the final subgrade elevation, whichever is deeper. The remainder of the drilled pier should remain in place. Foundation elements to remain in place should be surveyed and superimposed on the proposed development plans to determine the potential for obstructions to the planned construction. UES should be contacted if drilled piers are to be excavated and removed completely. Additional earthwork activities will be required to make the site suitable for new construction if the piers are to be removed completely.

Existing Utilities. Existing utilities and bedding to be abandoned should be completely

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removed. Existing utilities and bedding may be abandoned in place if they do not interfere with planned development. Utilities which are abandoned in place should be properly pressure-grouted to completely fill the utility.

Backfill. Excavations resulting from the excavation of existing foundations and utilities should be backfilled in accordance with Section 6.4.6.

Other Buried Structures. Other types of buried structures (wells, cisterns, etc.) could be located on the site. If encountered, UES should be contacted to address these types of structures on a case-by-case basis.

6.1.2 Possible Fill

Fill soil was not encountered at the boring locations. However, considering the previous structures at the project site, fill may be present in other areas of the site. In practice, it is difficult to accurately delineate fill soils that are similar to the native soils based on discrete test boreholes. Uncontrolled fills frequently contain trash, debris, concrete rubble, construction debris, boulders, and other unsuitable materials. Excavation and grading contracts should include provision for removal of unsuitable materials from the project site. Test pits could be performed prior to construction to assess the potential fill. UES would be pleased to assist with a test pit program if desired.

If compaction records of any existing fill are not available, the fill should be considered uncontrolled. All uncontrolled fill should be removed from the building areas. The resulting excavation should be properly backfilled with controlled fill as described in Section 6.4.6. Soils used to backfill the excavation or to raise site grades should consist of on-site or similar soils with a plasticity index of 20 or less.

6.2 Potential Movement of Expansive Soil

Estimated Potential Movement. Our findings indicate grade supported structures supported on grades referred to in Section 1.0 could experience post construction movements of about **1 inch** due to shrinking and swelling of expansive soils (active clays). For the purpose of this report, movement due to shrinking and swelling of active clays will be referred to as potential vertical movement/rise (PVR).

Method of Estimation. PVR was estimated in general accordance with methods outlined by Texas Department of Transportation (TxDOT) Test Method Tex-124-E, from results of absorption swell tests, and engineering judgment and experience. Estimated PVR calculated assuming the moisture content of the in-situ soil within the normal zone of seasonal moisture content change varies between the "dry" condition and a "wet" condition as defined by Tex-124-E. Also, it was assumed a 1 psi surcharge load from the floor slab acts on the subgrade soils. Movements exceeding our estimates could occur if positive drainage of surface water is not maintained or if soils are subject to an outside water source, such as leakage from a utility line or subsurface moisture migration from off-site locations.

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Assumptions. PVR was estimated based on the assumption that any fill used to raise the grade consists of onsite or similar soil with a plasticity index (PI) of 20 or less. The use of fill material with a PI greater than 20 could result in potential movements exceeding our estimates.

6.3 Subgrade Improvements to Reduce Expansive Soil Movements

Subgrade Treatment Using Select Fill. **We recommend the upper 1 foot of the building pad should consist of select fill. Also, any fill placed in the building pad areas (for grading purposes) should consist of select fill.** *It should be noted that the sandy/silty soils encountered at and near the ground surface at this site are prone to requiring the implementation of wet weather/soft subgrade recommendations provided in this report.*

Lateral Extents of Improvement. The recommended depth of select fill should extend throughout the entire building pad, at least 3 feet horizontally beyond the perimeter of the building, and below any additional flatwork for which it is desired to reduce movements.

Subgrade Improvement at Exterior Doorways. Subgrade improvement should extend beneath sidewalk areas that abut exterior doorways to the building. Failure to perform subgrade improvement in these areas can increase the probability of differential heaving between exterior sidewalks and doorways, resulting in exterior doors that will not or have difficulty opening outward due to “sticking” caused by heaving sidewalk slabs. Sidewalks tied to pavements and other flatworks that extend beyond the subgrades treated for PVR reduction may be subjected to movements similar to those experienced for untreated subgrades.

Risk Considerations. In choosing the above recommended technique for soil movement reduction, the Client is accepting some post construction movement of grade supported structures (about 1 inch). While structures can be designed to maintain structural integrity for a given level of movement, some degree of cosmetic distress manifesting in cracks, unevenness of floor slabs, differential movements, etc. associated with about 1 inch of movement should be expected. If some level of movement and associated risk is not acceptable, it will generally be required to structurally suspend the floor slab completely above the ground surface, out of contact with the expansive soils.

6.4 Earthwork

Variations in subsurface conditions could be encountered during construction. To permit correlation between test boring data and actual subsurface conditions encountered during construction, it is recommended a registered Professional Engineering firm be retained to observe construction procedures and materials.

Some construction problems, particularly degree or magnitude, cannot be reasonably

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anticipated until the course of construction. The recommendations offered in the following paragraphs are intended not to limit or preclude other conceivable solutions, but rather to provide our observations based on our experience and understanding of the project characteristics and subsurface conditions encountered in the borings.

6.4.1 Excavation Safety Considerations

Excavation Safety. The contractor is responsible for designing any excavation slopes, temporary sheeting or shoring. Design of these structures should include any imposed surface surcharges. Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods and sequencing of construction operations. The contractor should also be aware that slope height, slope inclination or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state and/or federal safety regulations, such as OSHA Health and Safety Standard for Excavations, 29 CFR Part 1926, or successor regulations. Stockpiles should be placed well away from the edge of the excavation and their heights should be controlled so they do not surcharge the sides of the excavation. Surface drainage should be carefully controlled to prevent flow of water over the slopes and/or into the excavations. Construction slopes should be closely observed for signs of mass movement, including tension cracks near the crest or bulging at the toe. If potential stability problems are observed, a geotechnical engineer should be contacted immediately. Shoring, bracing or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Texas.

6.4.2 Site Preparation and Proofroll

Site Clearing. In the area of improvements, all concrete, trees, stumps, brush, debris, septic tanks, abandoned structures, roots, vegetation, rubbish and any other undesirable matter should be removed and properly disposed.

Proofroll. Building pad and paving subgrades should be proofrolled in accordance TXDOT Specification Item 216 with a fully loaded tandem axle dump truck or similar pneumatic-tire equipment weighing at least 25 tons to locate areas of loose subgrade. In areas to be cut, the proofroll should be performed after the final grade is established. In areas to be filled, the proofroll should be performed prior to fill placement. Areas of loose or soft subgrade encountered in the proofroll should be removed and replaced with engineered fill, moisture conditioned (dried or wetted, as needed) and compacted in place. Prior to placement of any fill, the exposed soil subgrade should then be scarified to a minimum depth of 6 inches and recompacted as outlined in Section 6.4.6.

6.4.3 Construction Considerations

Surface Sandier/Siltier Soils. The sandier/siltier soils encountered at and near the ground surface at this site are very susceptible to changes in moisture. The presence of surface water due to precipitation or groundwater may result in a decrease in the ability to compact and work with the soil. It is common for these

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soils to pump when subjected to high levels of moisture. In addition, these soils located at and near the ground surface will allow surface water to infiltrate until the water becomes perched on a less permeable layer at depth. As such, construction difficulties should be anticipated, especially during the wet season or immediately after rain events. Although having a thin layer of non-plastic or low plasticity soils overlying cohesive soils is typical of this geologic region, our experience suggests that the local contractors find these materials troublesome and can often be the source of change orders, construction delays, and budget over runs. Soils of this type are especially prone to requiring the implementation of wet weather/soft subgrade recommendations provided in this report.

Maintenance of Subgrade during Construction. While the exposed subgrade is expected to remain relatively stable initially, unstable conditions may arise during general construction activities, particularly if the soil is exposed to wet weather conditions and repetitive construction traffic. The use of lighter construction equipment can help minimize disturbance to the subgrade. In the event of unstable conditions, stabilization measures will be necessary. After grading is completed, it's crucial to maintain the moisture content of the subgrade before proceeding with pavement construction. Minimizing construction traffic over the finished subgrade is advisable. If the subgrade becomes frozen, desiccated, saturated, or disturbed, the affected material should either be removed or treated by scarification, moisture conditioning, and recompaction before pavement construction begins. UES should be retained to observe earthwork and to perform necessary tests and observations during subgrade preparation.

Wet Weather/Soft Subgrade. Soft and/or wet surface soils may be encountered during construction, especially following periods of wet weather. Wet or soft surface soils can present difficulties for compaction and other construction equipment. If specified compaction cannot be achieved due to soft or wet surface soils, one of the following corrective measures will be required:

1. Removal of the wet and/or soft soil and replacement with select fill,
2. Chemical treatment of the wet and/or soft soil to improve the subgrade stability, or
3. If allowed by the schedule, drying by natural means.

Chemical treatment is usually the most effective way to improve soft and/or wet surface soils. UES should be contacted for additional recommendations if chemical treatment is planned due to wet and/or soft soils. The treatment depth and chemical reagent type and application rate depend on the site condition during construction.

6.4.4 Grading, Drainage and Other Considerations

Efforts should be made to minimize the excessive wetting or drying of the underlying soil, as it can lead to swelling and shrinkage of these soil layers. Standard construction practices of providing good surface water drainage should be used. A positive slope of the ground away from any foundation should be provided. Ditches or swales should be provided to carry the run-off water both during and after construction. Stormwater runoff

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should be collected by gutters and downspouts and should discharge away from the buildings.

In areas with pavement or sidewalks adjacent to the structure, a positive seal must be maintained between the structure and the pavement or sidewalk to minimize seepage of water into the underlying supporting soils. Post-construction movement of pavement and flatwork is common. Normal maintenance should include inspection of all joints in paving and sidewalks, etc. as well as re-sealing where necessary.

Since granular bedding backfill is used for most utility lines, the backfilled trench should not become a conduit and allow access for surface or subsurface water to travel toward the new structures. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water from traveling in the trench backfill and entering beneath the structures.

Root systems from trees and shrubs can draw a substantial amount of water from the clay soils at this site, causing the clays to dry and shrink in excess of our estimates. This could cause settlement beneath grade-supported slabs such as floors, walks and paving. Trees and large bushes should be located a distance equal to at least one-half their anticipated mature height away from grade slabs. Lawn areas should be watered moderately, without allowing the clay soils to become too dry or too wet.

6.4.5 Groundwater Control

Groundwater was encountered at depths of about 18 to 23 feet below the existing ground surface in the borings. However, from our experience, shallower groundwater seepage could be encountered in excavations for foundations, utilities and other general excavations at this site. The risk of seepage increases with depth of excavation and during or after periods of precipitation.

If groundwater is encountered during excavation, dewatering to bring the groundwater below the bottom of excavations may be required. Dewatering could consist of standard sump pits and pumping procedures, which may be adequate to control seepage on a local basis during excavation. Supplemental dewatering will be required in areas where standard sump pits and pumping is not effective. Supplemental dewatering could include submersible pumps in slotted casings, well points, or educators. For supplemental dewatering, the contractor should submit a groundwater control plan, prepared by a licensed engineer experienced in that type of work.

6.4.6 Fill Compaction

Select Fill. Select fill should consist of soil with a liquid limit of 35 or less and a Plasticity Index between 8 and 20. The select fill should be placed in loose lifts not exceeding 8-inches and should be compacted to at least 95 percent maximum dry density (per ASTM D-698) at a moisture content between optimum and 4 percent above optimum moisture content. The plasticity index and liquid limit of material used as select fill should be

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routinely verified during placement using laboratory tests. Visual observation and classification should not be relied upon to confirm the material to be used as select fill satisfies the required Atterberg-limit criteria.

Flexible Base Material. Flexible base material used as non-expansive material in the building pad should consist of material meeting the requirements of TxDOT Standard Specifications Item 247, Type A or D, Grade 1-2 or 3. The flexible base should be compacted to at least 98 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 2 percentage points below to 2 percentage points above the material's optimum moisture content.

General Fill. General fill may be placed in improved areas outside of building pad areas. General fill should consist of materials similar to onsite soils. General fill should be placed in loose lifts not exceeding 8 inches and should be uniformly compacted to a minimum of 95 percent maximum dry density (per ASTM D-698) and at a moisture content between optimum and 4 percent above optimum moisture content. The subgrade to receive general fill should be scarified to a depth of 6 inches and compacted to at least 95 percent maximum dry density (per ASTM D-698) and at a moisture content between optimum and 4 percent above optimum moisture content.

Fill Restrictions. Select fill, flexible base and general fill should consist of those materials meeting the requirements stated. Fill soils should not contain material greater than 4 inches in any direction, debris, vegetation, waste material, environmentally contaminated material, or any other unsuitable material.

Unsuitable Materials. Materials considered unsuitable for use as select fill or general fill include low and high plasticity silt (ML and MH), silty clay (CL-ML), organic clay and silt (OH and OL) and highly organic soils such as peat (Pt). These soils may be used for site grading and restoration in unimproved areas as approved by the Geotechnical Engineer. Soil placed in unimproved areas should be placed in loose lifts not exceeding 10 inches and should be compacted to at least 92 percent maximum dry density (per ASTM D-698) and at a moisture content within ±4 percentage points of optimum.

Fill Compaction Testing Guidelines. Field compaction and classification tests should be performed by UES. Compaction tests should be performed in each lift of the compacted material. We recommend the following minimum soil compaction testing be performed: one test per lift per 2,500 SF (with a minimum of two tests per lift) in the area of the building pad, one test per lift per 5,000 SF outside the building pad, and one test per lift per 100 linear feet of utility backfill. If the materials fail to meet the density or moisture content specified, the course should be reworked as necessary to obtain the specified compaction. Classification confirmation inspection/testing should be performed daily on select fill materials (whether on-site or imported) to confirm consistency with the project requirements. The testing frequency recommended herein can be altered (increased or decreased) at the discretion of the geotechnical engineer of record.

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6.4.7 Utilities

Bedding. Pipe bedding and pipe-zone backfill for underground utilities should meet the requirements of the pipe manufacturer. If no manufacturer requirement exists, then pipe bedding should be placed in accordance with applicable municipal or TxDOT requirements. Unless specified otherwise, the pipe-zone generally consists of all materials surrounding the pipe in the trench from six (6) inches below the pipe to 12 inches above the pipe. Since granular bedding backfill is used for most utility lines, the backfilled trench should not become a conduit and allow access for surface or subsurface water to travel toward the new structure. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water from traveling in the trench backfill and entering beneath the structure. At least 1 ft of soil cover should exist between concrete plugs and structural elements. Local municipality or jurisdiction take precedence over pipe bedding recommendations herein.

Backfill. The trench backfill for utilities should be properly placed and compacted as outlined in Section 6.4.6 and in accordance with requirements of local City standards. Utility backfill in the building pad should be placed in accordance with applicable requirements for the building pad.

Trench Settlement. Even if fill is properly compacted, fills in excess of about 10 ft are still subject to settlements over time of up to about 1 to 2 percent of the total fill thickness. This should be considered when designing pavement over utility lines and/or other areas with deep fill. Where utility lines are deeper than 10 ft, the fill/backfill below 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D 698) and within –2 to +2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as previously outlined. Density tests should be performed on each lift (maximum 12-inch thick) and should be performed as the trench is backfilled. Local municipality or jurisdiction take precedence over trench backfill recommendations herein.

Trench Excavation. If utility trenches or other excavations extend to a depth of 5 ft or more below construction grade, the contractor or others shall be required to develop an excavation safety plan to protect personnel entering the excavation or excavation 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, is beyond the scope of this study. Any such designs and safety plans shall be developed in accordance with current OSHA guidelines and other applicable industry standards.

6.4.8 Deep Fill Considerations

Deep Fill Compaction. Fills placed deeper than 10 ft should be compacted to at least 100 percent of standard Proctor maximum dry density (ASTM D 698) and within –2 to +2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as previously outlined. Density tests should be performed on each lift (maximum 12-inch thick) and should be performed as

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the trench is backfilled.

Deep Fill Settlement. Even if fill is properly placed and compacted as recommended herein, fills more than about 10 ft deep can still settle about 1 to 2 percent of its thickness due to its own weight, independent of external loads. This settlement generally begins as soon as lift placement begins. However, settlement can still occur for a period of time after completion of fill placement. The time required for settlement to occur is a function of soil type, pore water, and drainage path conditions and can vary widely. As a result, some fill-related settlement should be expected before and after final lifts are placed. Movement of grade supported structures (foundations, flatwork, etc.) related to settling fill can be reduced by allowing as much time as possible between the time the fill placement is completed and construction of the grade supported structure. If this risk of post construction settlement of deep fills is not acceptable, survey monitoring of constructed fills can be performed to evaluate the rate and magnitude of settlement prior to construction of structures on the fill. UES can provide this service if desired.

Note that settlement of deep fills is generally not critical if deep fills are strictly a result of recommended moisture conditioning depths to reduce potential movement of active clays.

6.5 Building Foundation System

Appropriate Foundation Types. We understand that the existing building is supported on underreamed drilled piers. The following foundation types are generally appropriate to the project and site based on the geotechnical conditions encountered:

- Underreamed drilled piers, or
- Shallow footings.

Foundation Determination. Foundation loading assumptions used in preparation of the following recommendations are summarized in Section 1.0. Final determination of the foundation type to be utilized for this project should be made by the Structural Engineer based on loading, economic factors and risk tolerance.

Avoidance of Mixing Foundation Types. Mixing of foundation types for a given building should be avoided. Where mixing foundation types is required for a given building, we should be contacted to review the foundation plans prepared by the Structural Engineer prior to construction. Mixed foundation types can have incompatible movement characteristics.

Foundations Adjacent to Existing Buildings. Differential movements can occur between the existing building and the proposed addition. Methods should be implemented to allow for differential movement between the foundation system of the existing building and the proposed addition. Further, preventative measures should be taken to avoid damaging or adversely affecting the integrity of the existing foundation system during construction.

Foundations Adjacent to Slopes. Foundations placed too close to adjacent slopes

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steeper than 5H:1V may experience reduced bearing capacities and/or excessive settlement. Recommendations provided herein assume foundations are not close enough to adjacent slopes in excess of 5H:1V to be detrimentally affected. Therefore, foundations closer than 5 times the depth of adjacent slopes, pits, or excavations in excess of 5H:1V should be brought to UES's attention to review the appropriateness of our recommendations.

Design Applicability. The following foundation design recommendations are based on project information discussed in Section 1.0.

Foundation Plan Review. UES should be provided with final foundation plans, details and related structural loads, with adequate time to review, prior to finalizing the design to verify conformance with recommendations presented herein.

6.5.1 Underreamed Drilled Piers

General. Underreamed drilled pier foundations bearing in native soil may be utilized at this site for the proposed building addition if recommendations in Sections 6.1 – Demolition Considerations and Possible Fill and 6.3 – Subgrade Improvements are followed.

Note: Groundwater and sandy soil conditions were encountered in the borings. ***Test piers should be performed prior to construction outside the foundation area to verify constructability of the underreams.*** If underream collapse occurs during test pier drilling, we should be contacted for further recommendations. Some field adjustments in the depth of the underreamed piers may still be required in some areas to maintain the bottom of the piers above any possible groundwater seepage and caving soils encountered near the bearing depth. Adjustments in the depths of the piers should be approved and observed in the field by UES personnel.

Foundation Depth. We recommend that underreamed piers should bear in competent, native soil at a depth of 10 feet below the final grade.

Bearing Capacity. The piers may be proportioned using a net dead load plus sustained live load bearing pressure of 3,000 psf or a net total load pressure of 4,500 psf, whichever condition results in a larger bearing surface. These bearing pressures are based on a safety factor of 3 and 2, respectively, against shear failure of the foundation bearing soils.

Settlement. Settlement of underreamed drilled pier foundations is influenced by several factors, including load (pressure), soil consolidation properties, depth to groundwater, geometry (width and length), depth, spacing, and quality of construction. Although a detailed settlement analysis is beyond the scope of this study, soil related settlement for foundations, 6 feet in diameter or less, constructed as described above should be about 1 inch. We should be allowed to review piers greater than 6-feet in diameter to assess their settlement. However, pier foundation settlement is heavily affected by construction quality and, as a result, oftentimes exceeds 1 inch. Our settlement estimate assumes

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that proper construction practices are followed and there are no overlapping stresses due to adjacent piers. To mitigate any overlapping stresses due to adjacent piers, we recommend a minimum clear spacing of one bell diameter (larger bell diameter) between adjacent piers.

Lateral Capacity. Because of the potential for the upper two feet of the soil to shrink and pull away from drilled piers during dry periods, we recommend soil resistance to lateral loads on drilled piers be ignored in the upper 2 feet of the soil profile. For resistance of lateral loads on drilled piers, we recommend the following LPILE design parameters.

Depth (feet) [1]	Soil Type	Effective Soil Unit Weight (pcf) [2]	Undrained Cohesion, Su (psf)	Angle of Internal Friction, φ (degrees)	Strain at ½ Peak Strength, ε_{50}	Soil Modulus Parameter, k (for lateral loads) (pci)
0 - 2	Sand	120	0	0	NA	NA
2 - 10	Clay	120	1,000	0	0.007	300

Notes:
1. Depth below existing/final grade.
2. Effective soil unit weight based on assumed groundwater depth greater than 10 feet bgs.

Uplift. The uplift force on the piers due to swelling of the active clays can be approximated by assuming a uniform uplift pressure of 300 psf acting over the perimeter of the shaft to a depth of 8 feet. The shafts should contain sufficient full length reinforcing steel to resist uplift forces.

Uplift Resistance. The uplift force due to swelling of active clays should be resisted by the underreamed portion of the pier. The underreamed portion should be at least two (2) and not exceeding 3 times the diameter of the shaft. The minimum clear spacing between edges of adjacent piers should be at least one (1) underream diameter, based on the larger underream.

Shaft/Diameter Ratio. The piers should be provided with an underream diameter to shaft diameter ratio not less than 2 to 1 and not greater than 2.5 to 1. ***Clayey sand soils at this site have isolated silt/sand seams and pockets and underream excavations may experience significant sloughing at some locations as a result. This site will be prone to requiring reduced underream to shaft diameter ratio in some locations. In a worst-case scenario, straight-shaft piers (with a straight-shaft diameter equal to the planned underream pier diameter) may be required at isolated locations. UES recommends test piers with underreams be constructed prior to finalizing the foundation design to assess the risk of bell collapse.***

Construction Observation. The construction of all piers should be observed as a means to verify compliance with design assumptions and to verify:

1. the bearing stratum;
2. underream size;

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3. the removal of all smear zones and cuttings;
4. that groundwater seepage, when encountered, is correctly handled; and
5. that the shafts are vertical (within acceptable tolerance).

We should be contacted for further evaluation and recommendations if soils other than those anticipated to be encountered at the design foundation bearing level, or if groundwater seepage and/or underream collapse occurs.

Groundwater. Groundwater was initially encountered at depths as shallow as 18-feet bgs in borings during drilling and did not rise within 15-minutes. However, groundwater may be encountered during pier excavation and the risk of groundwater seepage is increased during or after periods of precipitation. Submersible pumps may be capable of controlling seepage in the pier excavation to allow for concrete placement.

Applicable TxDOT Standards. Drilled pier foundations should be constructed in accordance with the requirements of TxDOT Item 416 (standard specification for construction of drilled pier foundations).

Concrete Placement. Concrete should be placed in the shafts immediately after excavation to reduce the risk of significant groundwater seepage, deterioration of the foundation-bearing surface and underream collapse. Concrete should have a slump of 5 to 7 inches and should not be allowed to strike the shaft sidewall or steel reinforcement during placement.

6.5.2 Shallow Footings

General Requirement. Shallow strip and spread footing foundations may be used for support of the proposed building addition provided that recommendations in Sections 6.1 – Demolition Considerations and Possible Fill and 6.3 – Subgrade Improvements are followed.

Foundation Depth. Shallow strip and spread footing foundations should bear on select fill or competent native soil at a minimum depth of 2 feet below the surrounding grade.

Bearing Capacity. Continuous strip footings can be proportioned using a net dead load plus sustained live load bearing pressure of 1,500 psf or a net total load bearing pressure of 2,250 psf, whichever condition results in a larger bearing surface. Individual spread footings can be proportioned using a net dead load plus sustained live load bearing pressure of 2,000 psf or a net total load bearing pressure of 3,000 psf, whichever condition results in a larger bearing surface. These bearing pressures are based on a safety factor of 3 and 2, respectively.

Geometry. Individual spread footings should be at least 30 inches wide and continuous strip footing foundations should be at least 16 inches wide.

Settlement. Settlement of footing foundations is influenced by several factors, including

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load (pressure), soil consolidation properties, depth to groundwater, geometry (width and length), depth, spacing, and quality of construction. Although a detailed settlement analysis is beyond the scope of this study, settlement for foundations, with a maximum horizontal dimension of 10 feet, constructed as described above should be about 1 inch. Differential movements should not exceed 75 percent of the predicted total movement. We should be allowed to review foundations larger than 10 feet to assess their settlement. Our settlement estimate assumes that proper construction practices are followed and there are no overlapping stresses due to adjacent footings. To mitigate any overlapping stresses due to adjacent footings, we recommend a minimum clear spacing of one footing width (width of larger footing) between adjacent footings.

Lateral Resistance. Resistance to lateral loads may be provided by the soil adjacent to the footings. We recommend using an equivalent fluid weight of 200 pcf for lateral resistance. A coefficient of sliding friction of 0.3 between the concrete footings and underlying soil may be combined with the passive resistance. Appropriate safety factor should be utilized by the structural engineer for lateral stability of the shallow footings. Lateral resistance should be neglected within 2 ft of final grade.

Construction and Observation. The geotechnical engineer should monitor foundation construction to verify conditions are as anticipated and that the materials encountered are suitable for support of foundations. Soft or unsuitable soils encountered at the foundation bearing level should be removed to expose suitable, firm soil. Foundation excavations should be dry and free of loose material. Excavations for foundations should be filled with concrete before the end of the workday or sooner if necessary to prevent deterioration of the bearing surface. Prolonged exposure or inundation of the bearing surface with water will result in changes in strength and compressibility characteristics. If delays occur, the excavation should be deepened as necessary and cleaned, in order to provide a fresh bearing surface. If more than 24 hours of exposure of the bearing surface is anticipated in the excavation, a “mud slab” should be used to protect the bearing surfaces. If a mud slab is used, the foundation excavations should initially be over-excavated by approximately 4 inches and a lean concrete mud slab of approximately 4 inches in thickness should be placed in the bottom of the excavation immediately following exposure of the bearing surface by excavation. The mud slab will protect the bearing surface, maintain more uniform moisture in the subgrade, facilitate dewatering of excavations if required and provide a working surface for the placement of formwork and reinforcing steel.

7.0 LIMITATIONS/GENERAL COMMENTS

As with any geotechnical engineering report, this report presents technical information and provides detailed technical recommendations for civil and structural engineering design and construction purposes. UES, by necessity, has assumed the user of this document possesses the technical acumen to understand and properly utilize the information and recommendations provided herein. UES strives to be clear in its presentation and, like the user, does not want potentially detrimental misinterpretation or

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misunderstanding of this report. Therefore, we encourage any user of this report with questions regarding its content to contact UES for clarification. Clarification will be provided verbally and/or issued by UES in the form of a report addendum, as appropriate.

Professional services provided in this geotechnical exploration were performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. The scope of services provided herein does not include an environmental assessment of the site or investigation for the presence or absence of hazardous materials in the soil, surface water or groundwater. UES, upon written request, can be retained to provide these services.

UES is not responsible for conclusions, opinions or recommendations made by others based on this data. Information contained in this report is intended for the exclusive use of the Client (and their designated design representatives), and is related solely to design of the specific structures outlined in Section 1.0. No party other than the Client (and their designated design representatives) shall use or rely upon this report in any manner whatsoever unless such party shall have obtained UES's written acceptance of such intended use. Any such third party using this report after obtaining UES's written acceptance shall be bound by the limitations and limitations of liability contained herein, including UES's liability being limited to the fee paid to it for this report. Recommendations presented in this report should not be used for design of any other structures except those specifically described in this report. In all areas of this report in which UES may provide additional services if requested to do so in writing, it is presumed that such requests have not been made if not evidenced by a written document accepted by UES. Further, subsurface conditions can change with passage of time. Recommendations contained herein are not considered applicable for an extended period of time after the completion date of this report. It is recommended our office be contacted for a review of the contents of this report for construction commencing more than one (1) year after completion of this report. Non-compliance with any of these requirements by the Client or anyone else shall release UES from any liability resulting from the use of, or reliance upon, this report.

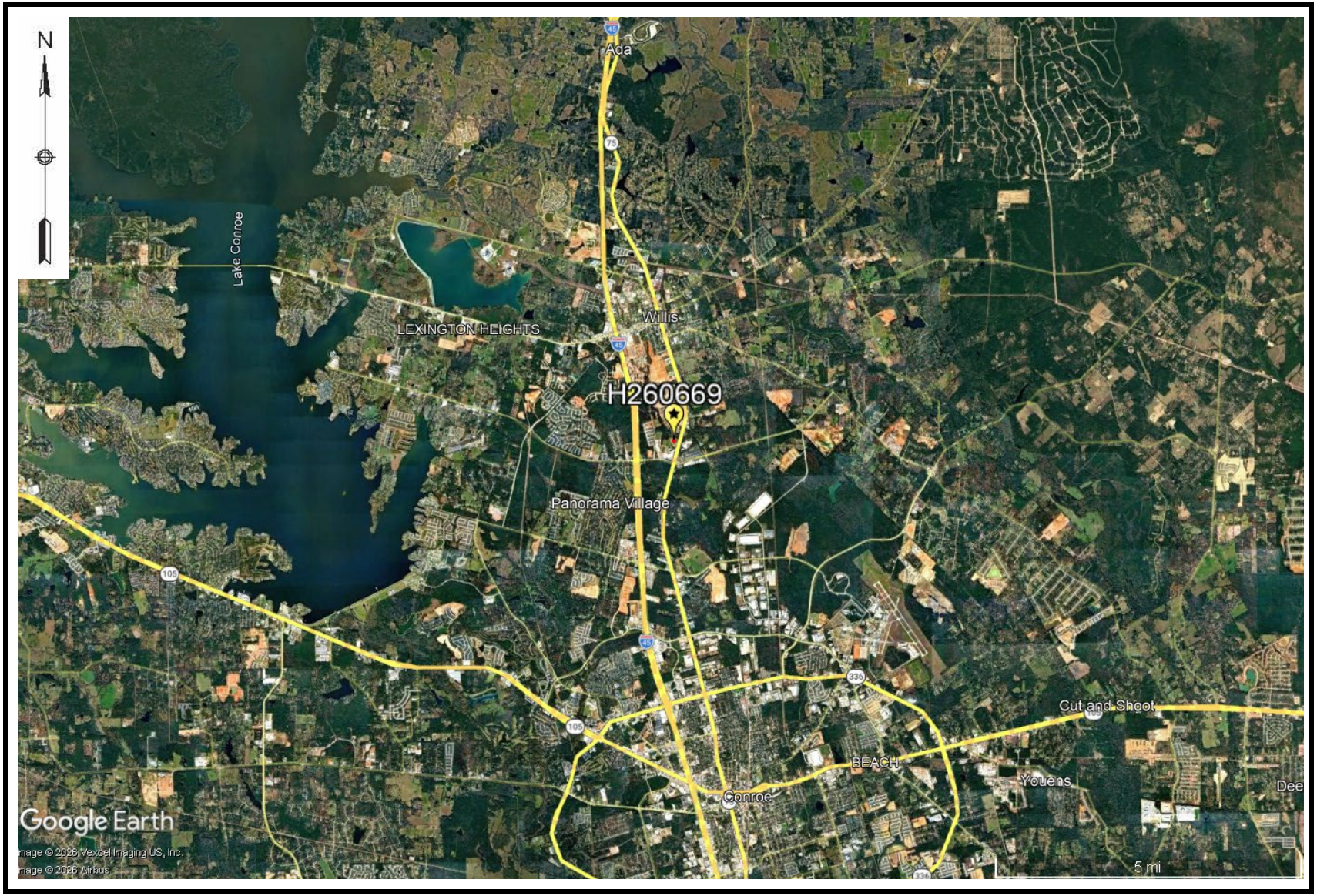
Recommendations provided in this report are based on our understanding of information provided by the Client about characteristics of the project. If the Client notes any deviation from the facts about project characteristics, UES should be contacted immediately since this may materially alter the recommendations. Further, UES is not responsible for damages resulting from workmanship of designers or contractors. It is recommended the Owner retain qualified personnel, such as a Geotechnical Engineering firm, to verify construction is performed in accordance with plans and specifications.

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Appendix A



PROJECT LOCATION DIAGRAM



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BORING LOCATION DIAGRAM



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Appendix B



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Boring Number: B-01

PROJECT A.R. Turner Elementary School Addition
GENERAL LOCATION Willis, TX 77378
PROJECT NUMBER H260669
LATITUDE - **LONGITUDE** -
DATE STARTED 03/19/2026
DATE COMPLETED 03/19/2026
HAMMER WEIGHT 140 lbs **HAMMER DROP** 30 inches
METHOD Auger 0 to 25 feet
ELEVATION N/A **DEPTH** 25'
DURING DRILLING 23' **AFTER DRILLING** 23'
COMMENTS -

Depth (ft)	Graphic Log	Material Description	Samples: Sample Graphic	Samples: REC (%) / RQD (%)	Samples: N-Value / Refusal / TCP	Samples: Pocket Pen (TSF)	Lab: Compressive Strength (TSF)	Lab: Confining Pressure (PSI)	Lab: Dry Density (PCF)	Lab: Moisture Content (%)	Lab: Liquid Limit	Lab: Plastic Limit	Lab: Plasticity Index	Lab: % Fines	Lab: % Swell
		CLAYEY SAND (SC) - Medium dense, light brown, reddish brown.				2.75				11	15	8	7	38	
		2													
		SILTY SAND (SM) - Loose, brown.			9					9					
		4													
5		LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) / SANDY LEAN CLAY (CL) - Soft to very stiff, reddish brown, light gray.				2.75				16					
						3.50				16	39	14	25		0.0
						2.50	1.4	0	106	15					
10															
						3.00				19					
15															
						2.25				18					
20															
▼		Brownish yellow, light gray from 23 to 25 feet.				.75	1.1	0	109	20					
25		25													
		End of Boring													

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Boring Number: B-02

PROJECT A.R. Turner Elementary School Addition
GENERAL LOCATION Willis, TX 77378
PROJECT NUMBER H260669
LATITUDE - **LONGITUDE** -
DATE STARTED 03/19/2026
DATE COMPLETED 03/19/2026
HAMMER WEIGHT 140 lbs **HAMMER DROP** 30 inches
METHOD Auger 0 to 25 feet
ELEVATION N/A **DEPTH** 25'
DURING DRILLING 23' **AFTER DRILLING** 23'
COMMENTS -

Depth (ft)	Graphic Log	Material Description	Samples: Sample Graphic	Samples: REC (%) / RQD (%)	Samples: N-Value / Refusal / TCP	Samples: Pocket Pen (TSF)	Lab: Compressive Strength (TSF)	Lab: Confining Pressure (PSI)	Lab: Dry Density (PCF)	Lab: Moisture Content (%)	Lab: Liquid Limit	Lab: Plastic Limit	Lab: Plasticity Index	Lab: % Fines	Lab: % Swell
		SILTY SAND (SM) - Brown. 2								7					
		SANDY LEAN CLAY (CL) - Very stiff, brownish yellow, light gray with ferrous nodules. 4				3.50	1.1	0	117	15					
5		CLAYEY SAND (SC) - Loose, brownish yellow, light gray with ferrous nodules. 6				1.00				11	17	10	7	39	
		SANDY LEAN CLAY (CL) / LEAN CLAY WITH SAND (CL) - Stiff to very stiff, Brownish yellow, light gray.				2.25				15					
		Reddish brown from 8 to 25 feet.				3.75				13					
10															
						1.75	1.8	0	113	15					
15															
						2.75				15					
20															
▼						1.50				17					
25		25													
		End of Boring													

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Boring Number: B-03

PROJECT A.R. Turner Elementary School Addition
GENERAL LOCATION Willis, TX 77378
PROJECT NUMBER H260669
LATITUDE - **LONGITUDE** -
DATE STARTED 03/19/2026
DATE COMPLETED 03/19/2026
HAMMER WEIGHT 140 lbs **HAMMER DROP** 30 inches
METHOD Auger 0 to 25 feet
ELEVATION N/A **DEPTH** 25'
DURING DRILLING 18' **AFTER DRILLING** 18'
COMMENTS -

Depth (ft)	Graphic Log	Material Description	Samples: Sample Graphic	Samples: REC (%) / RQD (%)	Samples: N-Value / Refusal / TCP	Samples: Pocket Pen (TSF)	Lab: Compressive Strength (TSF)	Lab: Confining Pressure (PSI)	Lab: Dry Density (PCF)	Lab: Moisture Content (%)	Lab: Liquid Limit	Lab: Plastic Limit	Lab: Plasticity Index	Lab: % Fines	Lab: % Swell
		SILTY SAND (SM) - Loose to medium dense, brown.								6					
		Reddish brown from 2 to 6 feet.			10					8	NV	NP	NP	26	
5		6			12					7					
		CLAYEY SAND (SC) - Medium dense, reddish brown.				1.50				9					
		Reddish brown, brownish yellow from 8 to 13 feet.				2.25				9	22	10	12		0.0
10		13													
		LEAN CLAY WITH SAND (CL) - Soft to very stiff, brownish yellow, light gray with sand seams.				4.25	2.2	0	112	17					
15															
						1.00	0.6		111	17					
20															
						3.00				17					
25		25													
		End of Boring													

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UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

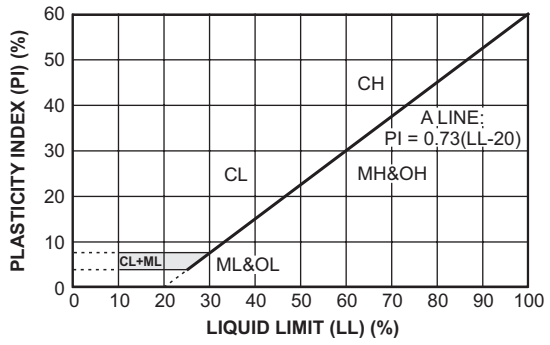
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



TERMS DESCRIBING SOIL CONSISTENCY

Fine Grained Soils		Coarse Grained Soils		
Description	Penetrometer Reading (tsf)	Penetration Resistance (blows/ft)	Description	Relative Density
Soft	0.0 to 1.0	0 to 4	Very Loose	0 to 20%
Firm	1.0 to 1.5	4 to 10	Loose	20 to 40%
Stiff	1.5 to 3.0	10 to 30	Medium Dense	40 to 70%
Very Stiff	3.0 to 4.5	30 to 50	Dense	70 to 90%
Hard	4.5+	Over 50	Very Dense	90 to 100%

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SECTION 004200
PROPOSAL FORM

PART "A" - BASE BID AND ALTERNATES

DATE___

1.01 TO:

KYLE HOEGEMEYER, PRESIDENT, BOARD OF TRUSTEES, WILLIS ISD, WILLIS, TEXAS.

A. Having carefully examined the project manual, drawings, and related documents entitled: A.R. Turner Elementary School Classroom Expansion as prepared by Huckabee, as well as the premises and conditions affecting the work, the undersigned proposes to furnish all materials, labor and equipment, and perform all work required by the contract documents for the construction of the A.R. Turner Elementary School Classroom Expansion project, in accordance with said documents, of which this Proposal is a part, for the following sum:

B. PROPOSAL ITEM NO. 1: For the construction of A.R. Turner Elementary School Classroom Expansion for Willis ISD in compliance with and as shown on the drawings and herein specified for the sum of:

$_____

C. ALTERNATE NO. 1A: Provide packaged rooftop air conditioning units manufactured by Carrier ILO Trane as specified in 23 7416 and in the drawings., (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

D. ALTERNATE NO. 1B: Provide packaged rooftop air conditioning units manufactured by York ILO Trane as specified in 23 7416 and in the drawings., (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

E. ALTERNATE NO. 1C: Provide packaged rooftop air conditioning units manufactured by Daikin ILO Trane as specified in 23 7416 and in the drawings., (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

F. ALTERNATE NO. 2: Installation of tile finish as scheduled on west wall (CMU wall) at rooms D123 BOYS and D124 GIRLS as specified and as shown in the drawings. Refer to plans for additional information., (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

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G. ALTERNATE NO. 3: Installation of bench along west wall at CORRIDOR D119, as specified and as shown in the drawings. Refer to plans for additional information., (choose one) **Add / Deduct** the sum of:

$_____

(choose one) **Add / Deduct** _____ consecutive calendar days if alternate is accepted.

H. Refer to Section 01 1400 Work Restrictions for specific project schedule. The Contractor acknowledges that they have read and understand the project schedule as stated in Section 01 1400. Please initial as acknowledged _____ (initials).

I. The undersigned agrees, if awarded the contract, to execute and deliver to the Owner, at the time of the signing of the contract, a Performance and Payment Bond of approved form through an approved bonding company duly authorized to do business in the State of Texas, and currently listed in the Department of Treasury Federal Register, which is acceptable surety within their Uni underwriting limitations on bonds, in favor of the Willis ISD as specified in the Instructions To Proposers contained in the project manual.

J. The undersigned further agrees that the Certified Check, Cashier's Check, or Proposal (Bid) Bond in the amount of five (5%) percent of his Proposal, payable to the Willis ISD, accompanying this Proposal, is left in escrow with the Architect, that it's amount is the measure of liquidated damages the Owner will sustain by the failure of the undersigned to execute and deliver the above-named agreement, or in furnishing the 100% Payment and Performance Bonds within ten (10) days of written notification of the award of the contract to him, then the Certified Check, Cashier's Check, or Proposal Bond shall become the property of the Owner; but if this Proposal is not accepted within forty-five (45) days of the time set for the submission of proposals, or if the undersigned executes and delivers said contract and bonds, the check shall be returned to him on receipt thereof.

K. For each day that the completion of the project extends beyond the stipulated completion dates, the Contractor agrees to pay to the Owner the sum of Zero and no/100 Dollars ($0.00) per day, and that this is the amount of liquidated damages the Owner will sustain for each day the time of completion of the project extends beyond the stipulated dates.

L. If he is notified of the acceptance of this Proposal within forty-five (45) days of the time set for the opening of proposals, he agrees to execute a contract for the above work for the above-stated compensation in the form of the Standard Agreement of the American Institute of Architects.

M. The undersigned agrees that the following unit prices may apply on any additions to, or deductions from the work, which prices shall include overhead, profit, taxes, and all other related costs. The unit prices shall be installed, in-place prices for materials/systems as specified. The quoted unit prices will be valid, and the quoted unit prices will be in force on any work. A singular cost shall be provided below to be used for both additions and deductions. If different prices are provided for additions and deductions the average of the absolute values will be used. The materials and work shall be in compliance with the specifications. The Contractor shall not be compensated for work that is not authorized by the Architect or Owners Laboratory (e.g. over drilling of piers and additional concrete and reinforcement for over drilled piers)

UNIT PRICING MATERIAL/SYSTEM	UNITS	COST ($)/UNIT
Clearing and Grubbing	Acre	
Import Fill	Cubic Yard	
Tree Removal	Units	
Demolition	Lump Sum	
6' Chain link Fence	Linear Foot	
Cement Stabilized Subgrade	Square Yard	
4" Concrete Flatwork	Square Yard	
6" Concrete Pavement	Square Yard	
Ramps	Units	
Wheel Stops	Units	
Signs and Striping	Lump Sum	
Connect to Ex. SS Line	Units	
Standard Sanitary Sewer Manhole	Units	
6" PVC Sewer Pipe	Linear Foot	
Post Construction TV Inspection	Linear Foot	
Vacuum Test for Manhole	Units	
4' SDMH	Units	
18"x18" Catch Basin	Units	
12"x12" Catch Basin	Units	
30" HDPE	Linear Foot	
24" HDPE	Linear Foot	
18" HDPE	Linear Foot	

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12" HDPE	Linear Foot	
8" HDPE	Linear Foot	
6" HDPE	Linear Foot	
Rock Rip Rap	Square Yard	
Stormwater Trench Safety	Linear Foot	
Erosion Control	Units	
TIF 419 Bermuda Sod	Square Foot	
Bermuda Hydromulch	Square Foot	
Temporary Irrigation	Lump Sum	
Excavation (Dirt or Caliche)	Cubic Yard	
Excavation (Rock)	Cubic Yard	
Backfilling (On Site)	Cubic Yard	
Utility backfill per the Foundation and Soil Preperation Notes on Sheet S0.0	Cubic Yard	
Building backfill with repurposed on-site soils per the Foundation and Soil Preperation Notes on Sheet S0.0	Cubic Yard	
Building backfill with select fill per the Foundation and Soil Preperation Notes on Sheet S0.0	Cubic Yard	
Reinforcing Steel, Straight or Bent Per the General Notes on S0.0	Pound	
Structural Steel Per the General Notes on S0.0	Pound	
Concrete Grout Per the General Notes on S0.0	Cubic Yard	
Concrete Masonry Units Per the General Notes on S0.0	Units	
Concrete Per the General Notes on S0.0 (Excluding piers, see below)	Cubic Yard	
Light Fixtures	Units	
Light Switches	Units	

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Power Outlets	Units	

N. It is further agreed that extended periods of labor strikes, unusual and destructive weather conditions that are beyond the normal weather patterns, and other generally recognized "Acts of God" will be cause for an approved extension of the above-stipulated completion of time schedule. It is also agreed that a request for extension of time will be made in writing by the Contractor to the Architect within fifteen (15) days after the time of occurrence for any consideration to be given the request. It is agreed that no additional funds are allowed for Extensions of Time.

O. Contractor has read and agrees with all provisions and articles of the contract documents.

Respectfully submitted,

Contractor:_____

Per:____

VENDOR COMPLIANCE TO STATE LAW

Willis ISD

Please answer the following questions and return with this bid:

Texas law prohibits cities and governmental units from awarding contracts to a non-resident unless the amount of such proposal by a Texas resident by the amount the Texas resident would be required to underbid in the non-resident bidder's state. For information regarding this series of questions, see Article 601g of the Texas Civil Statutes.

Is your principal place of business in Texas? Yes No (Circle One)

If no, in which state is your principal place of business? _____

If your principal place of business is not Texas, does your state favor resident bidders in your state by some dollar increment or percentage? Yes No (Circle One)

If yes, what is that dollar increment or percentage? _____

AUTHORIZED SIGNATURE_____

NAME OF COMPANY_____

ADDRESS_____

CITY_____ STATE_ ZIP CODE

DATE_____

NOTIFICATION OF HAZARDOUS MATERIALS AFFIDAVIT

STATE OF TEXAS

____ COUNTY

Before me, undersigned authority on this day personally appeared _____, _____known to me to be the person whose name is subscribed below, who, on oath stated:

"As the appropriate official of the company, contractor, or subcontractor submitting this affidavit in conjunction with a bid submitted to the Willis ISD, I acknowledge that this company, contractor, or subcontractor has been notified that copies of the Asbestos Hazard Emergency Response Act (AHERA) for the school(s) where such company, contractor or subcontractor has been contracted to perform work are available at the Willis ISD, Willis, Texas. I understand that it is our responsibility to familiarize ourselves with such plans and that it is our responsibility to inform every worker that we use on this project as to the availability of these plans.

We also acknowledge that we will be required to obtain clearance from the Willis ISD, prior to executing any work on this project."

Name of Company:_____

By:_____

Title:_____

STATE OF TEXAS

COUNTY OF ____

Sworn to and subscribed before my hand at _____, Texas this the day of _____, 20 _____, A.D.

_____

Notary Public in and for ____ County, Texas

END OF SECTION

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SECTION 004335
PROPOSAL FORM PART "B" QUALIFICATIONS

DATE _____

TO:

KYLE HOEGEMEYER, PRESIDENT, BOARD OF TRUSTEES, WILLIS ISD, WILLIS, TEXAS.

THE CONTRACTOR SHALL PROVIDE THE FOLLOWING INFORMATION IN THE SEQUENCE AND FORMAT PRESCRIBED HEREIN AND AS OUTLINED IN THE INSTRUCTIONS TO PROPOSERS SECTION 00 2116, PARAGRAPH 2.04.A AND 2.04.B. SUPPLEMENTAL MATERIALS PROVIDING ADDITIONAL INFORMATION MAY BE ATTACHED, BUT THE INFORMATION REQUESTED BELOW IS TO BE PROVIDED IN THIS FORMAT AND TABBED AS NOTED.

TAB 1: FIRM INFORMATION

Name of Firm:_____

Address of Principal Office:_____

Phone Number:_____

Fax Number:_____

Email Address and/or Web Address:_____

Form of Business Organization (Corporation, Partnership, Limited Liability Partnership, Individual, Joint Venture, other?):_____

Year Founded:_____

Primary individual to contact:_____

TAB 2: SCHEDULE:

The Proposer shall submit a schedule for this project.

State your organization's project plan or proposed approach to this project.

If selected, this proposed schedule shall become part of the Owner – Contractor Agreement AIA Document A101.

TAB 3: KEY PROJECT PERSONNEL:

Given the scope and schedule of the project, identify all proposed personnel for this project including but not limited to the Project Manager, Estimator, and Superintendent who would work on the project. Provide a resume and references for each individual. Note current projects on which individual is working including the project name, location, contract amount, percent complete, and the completion date of those projects. Also note the length of tenure with your company (hire date) for each proposed individual. Provide an organizational chart for this project noting whether the individual is On Site or Off Site. This organizational chart shall become part of the Owner – Contractor Agreement AIA Document A101. Members of the proposed team, once approved, shall not be changed without prior written approval of the Owner.

TAB 4: SUBCONTRACTORS:

Provide a list of all the major Subcontractors and Suppliers for each category listed below for this project.

• Earthwork	• Site Utilities
• Concrete	• Masonry
• Steel Fabrication	• Landscape and Irrigation
• Roofing	• Waterproofing
• Glass and Glazing	• Drywall

• Resilient Floor Covering/Carpet	• Ceramic Tile/Quarry Tile
• Terrazzo Flooring	• Painting
• Sprinkler System	• Plumbing
• Mechanical (HVAC)	• HVAC Controls
• Electrical	• Technology
• Fire Alarm	• Security
• Public Address	• Synthetic Turf and/or Running Tracks

You may provide a maximum of three (3) proposed Sub-contractors for each category. However, no additional Sub-contractors will be considered after submission of this list.

TAB 5: PROJECT EXPERIENCE:

List all educational projects and all other major projects constructed by your firm within the last five (5) years in similar scope and size to the project herein. For each project provide the name of the project; nature of the project/function of the building; size (square feet); locations; cost; completion date; name and contact person, address and phone number of both the Owner and Architect; and the manner in which your organization was selected (Bid, RFP, CM or other method).

TAB 6: FINANCIAL BACKGROUND:

Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

Current assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory, and prepaid expenses).
Non-current assets (e.g., net fixed assets, other assets).
Current liabilities (e.g., accounts payable, notes payable (current), accrued expenses, provision for income taxes, advances, accrued salaries and accrued payroll taxes).
Non-current liabilities (e.g., notes payable).
Capital accounts and retained earnings (e.g., capital, capital stock, authorized and outstanding shares par value, earned surplus and retained earnings).

Name and address of firm preparing attached financial statement and date thereof.

Is the attached financial statement for the identical organization named under item 1 above? If not, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent, and subsidiary).

Provide name, address, phone for bank reference.

Surety: Name of bonding company, name and address of agent. State total bonding capacity and total current bonding obligations with and without this project.

Please note that this information will be reviewed by the Owners Financial Officer or Consultant acting in that capacity. Reference Section 00 2116 for information regarding confidentiality.

TAB 7: CLAIMS AND SUITS:

List all lawsuits, requested arbitration and mediation with regard to construction contracts in the last ten (10) years.

List all judgments, claims, arbitration proceedings, mediation or suits pending or anticipated against your organization.

If your company has been in business less than ten (10) years then include any former company information if applicable.

TAB 8: QUALITY PROGRAM:

State your organization's overall approach to quality control for this project.

TAB 9: FELONY CONVICTION NOTICE:

FELONY CONVICTION NOTIFICATION

State of Texas Legislative Senate Bill No. 1, Section 44.034, Notification of Criminal History, Subsection (a), states "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

THIS NOTICE IS NOT REQUIRED OF A PUBLICLY-HELD CORPORATION

PLEASE COMPLETE THE INFORMATION BELOW

I, undersigned agent for the firm named below, certify that the information concerning notification of felony conviction has been reviewed by me and the following information furnished is true to the best of my knowledge.

VENDOR'S NAME:_____

AUTHORIZED COMPANY OFFICIAL'S NAME (PRINTED):_____

My firm is publicly-held corporation; therefore, this reporting requirement is not applicable.

Signature of Company Official:_____

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

Signature of Company Official:_____

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):_____
_____
_____

Signature of Company Official:_____

END OF SECTION

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SECTION 004393
PROPOSAL SUBMITTAL CHECKLIST

THE FOLLOWING ITEMS ARE TO BE SUBMITTED TO WILLIS ISD, AS DESCRIBED IN SECTION 001119 - REQUEST FOR COMPETITIVE SEALED PROPOSALS:

1.01 NOTE: ALL PROPOSALS MUST BE SUBMITTED ELECTRONICALLY THROUGH THE WILLIS ISD ONLINE BID PORTAL AT HTTPS://WILLISISD.IONWAVE.NET/LOGIN.ASPX.

1.02 PROPOSAL FORM PART "A"

SUBMITTED ON WEDNESDAY, JULY 15, 2026, NO LATER THAN 2:30 P.M.

A. Proposal Form – Part "A" – Base Bid Proposal

B. ( ) Bid Bond or Bid Security (Include base bid and all alternates)

C. ( ) Vendor Compliance to State Law

D. ( ) Notification of Hazardous Materials Affidavit

1.03 PROPOSAL FORM PART "B" – QUALIFICATIONS

SUBMITTED ON WEDNESDAY, JULY 15, 2026, NO LATER THAN 2:30 P.M.

A. ( ) Proposal Part "B" – Qualifications – five (5) copies of the information as outlined in the Proposal, Tabbed, and Bound.

B. ( ) Contractor's Qualification Statement AIA Document A305

C. ( ) Felony Conviction Notification Form

END OF SECTION

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SECTION 00 7343
WAGE RATE REQUIREMENTS

WATE RATES

A. Attention is called to the fact that the Contractor must comply with all Federal, State and Local labor laws, including Chapter 2258 Texas Government Code Title 10, which requires that the Contractor pay not less than the following prevailing wage rates and rates for legal holidays and overtime, which have been ascertained by the awarding body, as follows:

EXHIBIT A

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.

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Prevailing Wage Rates – School Construction Trades

June 2, 2025

Texas Gulf Coast Area

CLASSIFICATION	2025 HOURLY RATE
ASBESTOS WORKER	$27.20
BRICKLAYER; MASON	$24.90
CARPENTER; CASEWORKER	$23.13
CARPET LAYER; FLOOR INSTALLER	$26.20
CONCRETE FINISHER	$23.83
DATA COMM/TELE COMM	$24.33
DRYWALL INSTALLER; CEILING INSTALLER	$24.33
ELECTRICIAN	$29.86
ELEVATOR MECHANIC	$39.78
FIREPROOFING INSTALLER	$22.99
GLAZIER	$23.25
HEAVY EQUIPMENT OPERATOR	$22.17
INSULATOR	$21.95
IRONWORKER	$26.50
LABORER, HELPER	$19.81
LATHERER; PLASTERER	$22.75
LIGHT EQUIPMENT OPERATOR	$28.75
METAL BUILDING ASSEMBLER	$24.00
PAINTER; WALL COVERING INSTALLER	$20.17
PIPEFITTER	$29.82
PLUMBER	$27.98
ROOFER	$22.50
SHEET METAL WORKER	$29.96
SPRINKLER FITTER	$23.00
STEEL ERECTOR	$26.00
TERRAZZO WORKER	$22.75
TILE SETTER	$22.00
WATERPROOFER; CAULKER	$24.00

This document was developed by PBK Architects, Inc., in strict accordance with Chapter 2258 of the Texas Government Code.

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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 build 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.
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.

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SECTION 011100
SUMMARY OF WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:
   1. The "Project" of which the "Work" of this Contract is a part, is titled A.R. Turner Elementary School Classroom Expansion for Willis ISD and is composed of a 10 classroom addition and related site work located in Willis, Texas.
   2. The "Work" of this Contract is titled A.R. Turner Elementary School Classroom Expansion and is defined in the Contract Documents to include, but not necessarily to be limited to:
      a. A 10 classroom addition, including all mechanical, electrical, plumbing, and general construction work.
   3. 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.
      b. The work of other contracts is described in various contract documents prepared therefore, some of which are in the possession of the Owner and are available for inspection by interested parties.

B. Other Work:
   1. Owner (if required by Municipality, State or Federal requirements) shall provide evidence to the municipality permitting the project that an asbestos survey has been completed by a person licensed under the Texas Asbestos Health Protection Act to perform such a survey.
   2. The architect has no responsibility for the discovery, presence, handling, removal or disposal of or exposure of persons to hazardous materials or toxic substances in any form at the project site.
   3. The architect is not required to execute certifications that would require knowledge, services or responsibilities beyond the scope of the architectural service agreement.
   4. The architect assists the owner in the owner's responsibility to obtain applicable permits for demolition and construction.
   5. Contractor to review and familiarize themselves with owner's Asbestos survey and plan and shall inform every worker that they use on this project as to the availability of these surveys and plans prior to starting any work.

END OF SECTION

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SECTION 011400
WORK RESTRICTIONS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work Included:
   1. Contractor shall comply with the following requirements concerning scope and work restrictions.
   2. If the Contractor believes that meeting the restrictions in this section would cause a delay to the intended schedule, they shall issue an RFI requesting specific modifications to that specific Work Restriction that would permit construction to continue without delay and indicating the reasons for the request. If construction proceeds without meeting any of the restriction requirements or obtaining approval for a modification of these requirements, the Contractor shall be responsible for all costs associated with removing and replacing all construction that occurred in violation of the Work Restrictions, if directed to by the Architect, without any increase in approved construction costs or schedule for the project.

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.
   2. The work of other contracts is described in various contract documents prepared therefore, some of which are in the possession of the Owner and are available for inspection by interested parties.

C. Specific Project Restrictions:
   1. Contractor shall be advised that the school will be operating during the duration of this project.
   2. Contractor shall coordinate with the Owner any activities which will disrupt normal school operations.
   3. Before project completion and a certificate of occupancy is issued, Contractor shall provide fully established grass at locations including but not limited to all disturbed areas, under items that have been stored on site, construction trailers and storage units.
   4. Contractor may begin construction on or about September 3, 2026 and shall be substantially complete on July 1, 2027.

D. Project restrictions related to Quality Control
   1. The Contractor shall not be permitted to begin work on-site (other than job trailer installation and/or removal of on-site vegetation) until the Contractor has scheduled and hosted a “Foundation Pre-Construction” meeting (in person or on a conference call) with the Architect’s Construction Observer, a representative of the Special Inspection and Testing Agency (SITA), the Code-Required Structural Observer, a representative of the Structural Engineer, the Superintendent of Construction, Contractor’s Project Manager, and all foremen for subcontractors with work related to the foundation.
   2. The Contractor shall not be permitted to continue work on-site (other than job trailer installation and/or removal of on-site vegetation) more than one week after the Foundation Pre-Construction meeting (or an alternative deadline if requested by the Contractor and approved by the Architect) unless:

a. The Contractor has obtained correspondence from the Geotechnical Engineer indicating that the Geotechnical Engineering firm has reviewed all relevant Construction Documents for conformance with their recommendations and indicated any portions of these documents which, in their opinion, do not conform with their recommendations. The term "relevant Construction Documents" shall include this Project Manual, all construction drawing sheets, any addenda issued before proposals are received, any addenda issued after proposals are received but before an Owner/Contractor Agreement is fully executed, and any changes in scope associated with a Request For Proposal (RFP) that is approved before construction begins.
b. The Contractor has obtained verification in writing from the Architect that the SITA has issued one or more acceptable statements indicating the SITA will be performing the scope of work for the SITA specified in Section 01 4533 and that the SITA as well as all SITA Staff that will be performing work on this project will meet the qualifications specified in Section 01 4533.
c. The Contractor has obtained verification in writing from the Mechanical and Electrical Engineers that the CxA has issued one or more acceptable statements indicating the CxA will be performing the scope of work for the CxA specified in Section 01 4533 and that the CxA as well as all CxA Staff that will be performing work on this project will meet the qualifications specified in Section 01 4533. This verification shall also confirm that the specified commissioning services on this project comply with the applicable version of the International Energy Conservation Code (IECC).
d. The Contractor has submitted to Willis ISD, the Building Official, and the Architect a written "Acknowledgement of Contractor's Responsibilities Related to Code-Required Quality Control". (Refer to Section 01 4533 for suggested language.)
e. The Contractor has confirmed in writing to the Architect that the Contractor has scheduled and hosted a "Quality Control Pre-Construction Meeting", following the agenda in Section 01 4533, listing the names and project roles of all attendees.

3. The Contractor shall not be permitted to apply for a Certificate of Occupancy until the Contractor has obtained a copy of each Final Report of Quality Control from every firm providing quality control services where required by the Final Report provisions of Section 01 4533 and, in addition, the Contractor has submitted to the AHJ the Final Report of Quality Control from the SITA, the Final Report of Quality Control from the CxA and the Final Report of Quality Control from the Code-Required Structural Observer. (The Contractor shall submit reports from the other quality control personnel if requested by the AHJ.)

E. Project Restrictions related to the General Framing Preconstruction Meeting

1. The Contractor shall not be permitted to install any portion of the superstructure until the Contractor has schedules and hosts a "General Framing Preconstruction Meeting" in which the following people attend: A representative of the Architect, a representative of the Structural Engineer, the SITA, the Superintendent of construction, the Contractor's Project Manager, and all foremen for subcontractors with work related to the framing.

END OF SECTION

SECTION 012100
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cash allowances.

B. Contingency allowance.

C. Payment and modification procedures relating to allowances.

1.02 CASH ALLOWANCES

A. Cash Allowances shall be included in the contract sum.

B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will not be included in Change Orders authorizing expenditure of funds from this Cash Allowance. These costs shall be included in base contract sum unless noted otherwise

C. Costs Not Included in Cash Allowances: Product handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing. These costs shall be included in base contract sum unless noted otherwise.

D. Architect Responsibilities:
   1. Consult with Contractor for consideration and selection of products, and installers.
   2. Select products in consultation with Owner and transmit decision to Contractor.
   3. Prepare Change Order.

E. Contractor Responsibilities:
   1. Assist Architect in selection of products, suppliers, and installers.
   2. Obtain proposals from suppliers and installers and offer recommendations.
   3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.

F. Differences in costs will be adjusted by Change Order.

G. At closeout of Contract, funds remaining in Cash Allowance will be credited to Owner by Change Order.

1.03 CONTINGENCY ALLOWANCE

A. Owner's Contingency Allowance: $275,000.00.

B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will not be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.04 ALLOWANCES SCHEDULE

A. Section 01 5000 - Temporary Facilities and Control: Include the stipulated sum of $1,500 for purchase of project identification sign.

B. Include the stipulated sum of $60,000.00 for the purchase and installation of the Emergency Radio Communication System.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 012200
UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Measurement and payment criteria applicable to Work performed under a unit price payment method.

1.02 COSTS INCLUDED

A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.03 MEASUREMENT OF QUANTITIES

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. Measurements and quantities will be verified by Architect.

C. Assist by providing necessary equipment, workers, and survey personnel as required.

D. 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.

E. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

F. Measurement by Area: Measured by square dimension using mean length and width or radius.

G. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.

1.04 PAYMENT

A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

B. The following unit prices may apply on any additions to, or deductions from the work, which prices shall include overhead, profit, taxes, and all other related costs. The unit prices shall be installed, in-place prices for materials/systems as specified. The quoted unit prices will be valid, and the quoted unit prices will be in force on any work. A singular cost shall be provided below to be used for both additions and deductions. If different prices are provided for additions and deductions the average of the absolute values will be used. The materials and work shall be in compliance with the specifications. The Contractor shall not be compensated for work that is not authorized by the Architect or Owners Laboratory (e.g. over drilling of piers and additional concrete and reinforcement for over drilled piers)

1.05 SCHEDULE OF UNIT PRICES

UNIT PRICING MATERIAL/SYSTEM	UNITS	COST ($)/UNIT
Clearing and Grubbing	Acre	
Import Fill	Cubic Yard	
Tree Removal	Units	

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Demolition	Lump Sum	
6' Chain link Fence	Linear Foot	
Cement Stabilized Subgrade	Square Yard	
4" Concrete Flatwork	Square Yard	
6" Concrete Pavement	Square Yard	
Ramps	Units	
Wheel Stops	Units	
Signs and Striping	Lump Sum	
Connect to Ex. SS Line	Units	
Standard Sanitary Sewer Manhole	Units	
6" PVC Sewer Pipe	Linear Foot	
Post Construction TV Inspection	Linear Foot	
Vacuum Test for Manhole	Units	
4' SDMH	Units	
18"x18" Catch Basin	Units	
12"x12" Catch Basin	Units	
30" HDPE	Linear Foot	
24" HDPE	Linear Foot	
18" HDPE	Linear Foot	
12" HDPE	Linear Foot	
8" HDPE	Linear Foot	
6" HDPE	Linear Foot	

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Rock Rip Rap	Square Yard	
Stormwater Trench Safety	Linear Foot	
Erosion Control	Units	
TIF 419 Bermuda Sod	Square Foot	
Bermuda Hydromulch	Square Foot	
Temporary Irrigation	Lump Sum	
Excavation (Dirt or Caliche)	Cubic Yard	
Excavation (Rock)	Cubic Yard	
Backfilling (On Site)	Cubic Yard	
Utility backfill per the Foundation and Soil Preperation Notes on Sheet S0.0	Cubic Yard	
Building backfill with repurposed on-site soils per the Foundation and Soil Preperation Notes on Sheet S0.0	Cubic Yard	
Building backfill with select fill per the Foundation and Soil Preperation Notes on Sheet S0.0	Cubic Yard	
Reinforcing Steel, Straight or Bent Per the General Notes on S0.0	Pound	
Structural Steel Per the General Notes on S0.0	Pound	
Concrete Grout Per the General Notes on S0.0	Cubic Yard	
Concrete Masonry Units Per the General Notes on S0.0	Units	
Concrete Per the General Notes on S0.0 (Excluding piers, see below)	Cubic Yard	
Light Fixtures	Units	
Light Switches	Units	
Power Outlets	Units	

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 012300
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Procedures for pricing Alternates.

1.02 RELATED REQUIREMENTS

A. Document 00 2116 - Instructions to Proposers

1.03 PROCEDURES

A. Proposers are required to submit alternate proposals to add work or to deduct work from the base proposal as described below. Failure to submit alternate amounts in spaces provided on proposal form is basis for disqualification of proposal.

B. The successful proposer shall not modify, withdraw or cancel any of the alternate proposals or any part thereof for 45 days after date of receipt of proposals, unless specifically noted otherwise.

C. Contractor shall be responsible for any changes in the work affected by acceptance of these alternates. Include within the alternative proposal prices all costs, including materials, installations, and fees.

D. Claims for additional dollars resulting from changes caused by the alternates will not be allowed.

E. Refer to the drawings and project manual for items of work affected by alternates.

F. Alternates will be exercised at the option of the Owner.

G. Coordinate related work and modify surrounding work as required to complete the Work, including changes under each alternate, when acceptance is designated in the Owner - Contractor Agreement.

1.04 ACCEPTANCE OF ALTERNATES

A. Indicate variation of proposal price for alternates described below and list on the proposal form or any supplement to it, which requests a 'difference' in proposal price by adding to or deducting from the base proposal price or by indicating "No Charge".

B. Indicating "No Bid" as an alternate is unacceptable and is reason for rejection of the proposal.

C. Alternates quoted on Bid / Proposal Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

D. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.05 SCHEDULE OF ALTERNATES

A. Alternate Number 1A:
   1. Provide packaged rooftop air conditioning units manufactured by Carrier ILO Trane as specified in 23 7416 and in the drawings.

B. Alternate Number 1B:
   1. Provide packaged rooftop air conditioning units manufactured by York ILO Trane as specified in 23 7416 and in the drawings.

C. Alternate Number 1C:
   1. Provide packaged rooftop air conditioning units manufactured by Daikin ILO Trane as specified in 23 7416 and in the drawings.

D. Alternate Number 2:

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1. Installation of tile finish as scheduled on west wall (CMU wall) at rooms D123 BOYS and D124 GIRLS as specified and as shown in the drawings. Refer to plans for additional information.

E. Alternate Number 3:
1. Installation of bench along west wall at CORRIDOR D119, as specified and as shown in the drawings. Refer to plans for additional information.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Schedule of Values.

E. Progress meetings.

F. Submittal Schedule.

G. Submittals for review and project closeout.

H. Number of copies of submittals.

I. Submittal procedures.

J. Progress Payments.

K. Contractor's Daily Field Report.

L. Request For Information.

1.02 RELATED REQUIREMENTS

A. Section 01 1100 - Summary of Work

B. Section 013216 - Construction Progress Schedule: Form, content, and administration of schedules.

C. Section 016000 - Product Requirements: General product requirements.

D. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.

E. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. The Notice to Proceed shall not be issued by the Architect until the Agreement (or Amendment, if Contractor is a Construction Manager at Risk) including final GMP and all exclusions or other post Proposal agreements, have been signed and approved as well as all required payment and performance bonds and insurance, and furnished to the Architect.

B. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

C. Make the following types of submittals to Architect:
   1. Requests for Information (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.
   12. Warranty request and corrective action descriptions.

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. This includes submittals for review, information, requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), field reports and meeting minutes, preliminary closeout for review, final project record documents closeout submittal and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service at no cost to the Contractor.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed.
   7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:
   1. Autodesk Construction Cloud (ACC): https://acc.autodesk.com.
      a. Contractor will receive an emailed invitation to the ACC project upon award.

C. Training: External user tutorials are availible at https://learnacc.autodesk.com. The awarded General Contractor will be required to become familiar with the program prior to Notice to Proceed being issued.

D. Project Closeout: Architect will determine when to terminate the service for the project. Contractor is responsible for providing digital and hard copies of the final project record documents closeout submittal to the Owner. Should Owner forgo hard copies, Contractor shall submit a credit to the Owner.

3.02 PRECONSTRUCTION MEETINGS

A. A Kick-Off Pre-Construction meeting will be scheduled to be held upon notification by the Architect.
   1. Provide attendance by authorized representatives of the Contractor and major subcontractors.
   2. The Architect will advise other parties, including the Owner, and request their attendance.
   3. The Architect shall arrange, preside, and record the minutes of the pre-construction meeting.
   4. A pre-construction meeting agenda will be issued by the Architect at the meeting.
   5. Agenda items to be discussed include:
      a. Self introductions
      b. Design concept, scope, and objectives
      c. Communications
      d. Contractor’s responsibilities
      e. Documentation and notification
      f. Progress Meetings
      g. Submittals/Substitutions

h. Project Administration
i. Project Closeout
j. Warranty Phase

B. Foundation Pre-Construction Meeting
1. Before beginning any work on-site (other than job trailer installation and/or removal of on-site vegetation) the Contractor shall schedule and host a “Foundation Pre-Construction” meeting (in person or on a conference call) with the Architect’s Construction Observer, a representative of the Special Inspection and Testing Agency (SITA), the Code-Required Structural Observer, a representative of the Structural Engineer, the Superintendent of Construction, Contractor’s Project Manager, and all foremen for subcontractors with work related to the foundation.

C. Quality Control Pre-Construction Meeting
1. Within one week after the “Foundation Pre-Construction Meeting”, the Contractor shall schedule and host a “Quality Control Pre-Construction Meeting” following the Agenda in Section 01 4533.

D. Framing Pre-Construction Meeting: The Contractor shall not be permitted to install any portion of the superstructure above the foundation until the Contractor has scheduled and held a "General Framing Preconstruction Meeting" in which the following people attend: A representative of the Architect, a representative of the Structural Engineer, the Special Inspection and Testing Agency (SITA), the Superintendent of construction, the Contractor's Project Manager, and all foremen for subcontractors with work related to the framing.

3.03 SCHEDULE OF VALUES AND DRAWDOWN SCHEDULE

A. Within twenty-one (21) calendar days following Notice to Proceed, the Contractor shall submit a Schedule of Values (using the breakdown of the Construction Schedule activities) for review by the Owner’s Representatives. The Schedule of Values will allocate a dollar value (cost) for each activity of the Construction Schedule. Each activity cost allocation shall include a labor, equipment and material cost and a pro rata contribution to overhead and profit. The sum of all activity costs shall be equal to the total Contract Sum. Each activity cost shall be coded with a cost code corresponding to the subcontractor responsible for the Work so that subtotals for each division of the Work can be prepared.

B. Within twenty-one (21) calendar days following Notice to Proceed, the Contractor shall submit a Drawdown Schedule showing anticipated monthly payments from the Owner for coordination of allocated funds for the Project.

C. Within thirty (30) calendar days following Notice to Proceed, the Contractor shall participate in a conference with the Owner’s Representatives to review, evaluate and approve the Schedule of Values and Drawdown Schedule. The approved Schedule of Values and Drawdown Schedule shall, in the best judgment of the Contractor, the Project Manager, and the Architect represent a fair, reasonable, and equitable dollar (cost) allocation for each activity on the Construction Schedule.

3.04 PROGRESS MEETINGS

A. Schedule and administer jobsite meetings throughout progress of the Work in intervals agreed to at the Preconstruction Meeting.

B. Contractor will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings. Agendas and prior meeting minutes shall be distributed 24 hours prior to meeting.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers (as invited), Owner, Architect, as appropriate to agenda topics for each meeting. Representation should be consistent throughout project.

D. Agenda:
1. Review minutes of previous meetings.

2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Status of Request for Information (RFI).
14. Status of Request for Change Proposal (RFP).
15. Other business relating to work.
16. Construction forecast for 3 weeks.
17. Weather Delay Requests.
18. Quality Control.

E. Record minutes and distribute typewritten copies within two days after meeting to participants, with one copy to Architect, Owner, participants, and those affected by decisions made.
   1. Unless published minutes are challenged in writing prior to the next regularly scheduled progress meeting, they will be accepted as properly stating the activities and decisions of the meeting.
   2. Persons challenging published minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
   3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting.

3.05 SUBMITTAL SCHEDULE

A. Within twenty-one (21) business days following the Notice to Proceed, the Contractor shall submit a Submittal Schedule for review by the Architect and Owner. This schedule shall coincide with the approved Construction Schedule accommodating the submittal review and material selection times as required by Architect, Owner or Owner's Representatives. In the event a submittal schedule is not provided and approved by the Architect, Owner, or the Owner's Representative at the submission of the 2nd pay application, the 2nd pay application will be held until the submittal schedule is complete as noted above.

B. This schedule shall list all required submittals, product data, and samples for the project. Each item to be submitted shall include the date to be submitted, review time and the scheduled installation date. All submittals shall be listed and sequenced within the Submittal Schedule in accordance with the approved Construction Schedule.

C. The Architect and Owner will review the Submittal Schedule, provide revision comments and return it to the Contractor within fourteen (14) business days. If revisions are required, the Contractor shall then resubmit a revised Submittal Schedule to the Architect and Owner within fourteen (14) business days and thereafter until approved,

D. Submittals, product data and samples submitted out of sequence to the approved Submittal Schedule or Construction Schedule will be subject to return as unchecked and required to be resubmitted at a date coinciding with these schedules. The Submittal Schedule is advisory only and shall not relieve the Contractor of the responsibility for accomplishing the Work within each and every Contract required Milestone and Completion date. Omissions and errors in the approved Submittal Schedule shall not excuse the Contractor from providing required submittals, product data or samples, nor excuse the Contractor from meeting the Contract required Milestones and Completion date.

3.06 SUBMITTAL DEFINITIONS AND REQUIREMENTS

A. Shop Drawing
   1. Shop drawings, diagrams, schedules and other data specifically prepared for the work by the contractor, subcontractor, manufacturer, or supplier to illustrate some portion of the work.

B. Product Data
   1. Product data are illustrations, standard schedules, performance charts, instructions, and brochures, furnished by the contractor to illustrate materials or equipment to illustrate some portion of the work.

C. Sample
   1. Physical examples which illustrate materials for some portion of the work evaluated for product compliance.

D. Color Sample
   1. Physical examples which illustrate color or texture for use in color selection.

E. Submittal
   1. The submittal is the compilation of the shop drawing, product data, sample, color sample as requested by the specifications.

3.07 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. The Architects review of the Contractors submittal shall be limited to examination of an initial submittal and one resubmittal. The Architect's review of additional submittals, beyond that of the initial and resubmittal, will be made only with prior written approval of the Owner after notification by the Architect.

D. Contractors review of submittals shall be consistent with A201 – General Conditions. Areas of deviation from the Contract Documents will be represented by revision clouds, Green in color, made by the General Contractor on the associated PDF document. In the event there are no clouded areas identified, it can be assumed that the associated submittal has been reviewed in full by the General Contractor and are deemed approved. No further review by the Architect is required.

E. Samples
   1. Contractor shall submit all products which require a color selection. Contractor shall only submit actual product sample. Remainder of submittal shall be retained by contractor. Refer to color sample procedures below.
   2. Provide sample identical to the precise article proposed to be provided. If actual sample is not provided for substitution review, submittal will be rejected.
   3. Unless otherwise specified, submit one sample which will be retained by the Architect.
   4. Samples will be reviewed only for aesthetic, color, or finish selection.

F. Fax submittals are not acceptable.

G. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. Within sixty (60) days following the Notice to Proceed, the Contractor shall submit a list of Expected Closeout Documents for review by the Architect. This list shall include project record documents, operation and maintenance data, warranties, bonds, contract forms, health/safe environment data, attic stock sign offs, Owner training, certifications and inspections, and other types as indicated. All items on the list shall be titled with spec section number and general description - Example: "09 3000 Tiling - 1 year warranty".

B. The Architect will review the list of Expected Closeout Documents, provide revision comments and return it to the Contractor within fourteen (14) business days. If revisions are required, the Contractor shall then resubmit a revised list to the Architect and Owner within fourteen (14) business days and thereafter until approved.

C. Contractor may submit Closeout Documents by Specification Division in full as scopes of work are completed.

D. Submit Correction Punch List for Substantial Completion.

E. Submit Final Correction Punch List for Substantial Completion.

F. Submit for Owner's benefit during and after project completion.

G. See Section's 01 7000 and 01 7800 for additional details.

3.09 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Extra Copies at Project Closeout: See Section 017800.

C. Samples: Submit one sample as specified in individual specification sections which will be retained by Architect. All other samples required by the individual specification section shall be retained by the Contractor.
   1. After review, Contractor shall produce duplicates if needed for other purposes.
   2. The Architect's sample will not be returned to Contractor.

3.10 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Transmit using approved form.
   2. Acceptable Manufacturers
      a. Manufacturers submitted shall be as per the acceptable manufacturers listed in each specification. For additional manufacturers requiring approval, reference Section 01 6000 – Product Requirements.
   3. Sequentially identify each item. For revised submittals use original number and a sequential alphabetical suffix.
   4. Submittals shall be numbered as follows:
      a. Number shall be Architects project number followed by the appropriate specification section - consecutive submittal number for section.
      b. Example - 1234-01-01 Tiling 09 3000 - 5.
      c. When material is re-submitted for any reason, transmit under a new letter of transmittal and with a new transmittal number.
      d. On re-submittals, cite the original submittal number for reference.
      e. On at least the first page of each submittal, and elsewhere as required for positive identification, show the submittal number in which the item was included.
      f. When multiple projects are administered under one contract, contractor shall submit separate submittals for each project. Failure to submit separately will result in a rejected submittal review.
      g. Unless otherwise specified, make submittals in groups containing all associated items to assure that information is available for checking each item when it is received.

1) Partial submittals may be rejected as not complying with the provisions of the Contract.
2) The Contractor may be held liable for delays so occasioned.
3) Multiple projects bid under a single prime shall package submittals separately for each project.

5. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
6. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
   a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
7. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
   a. Upload submittals in electronic form to Electronic Document Submittal Service website.
8. Schedule submittals to expedite the Project, and coordinate submission of related items.
   a. For each submittal for review, allow 14 days excluding delivery time to and from the Contractor.
9. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
10. Provide space for Contractor and Architect review stamps.
11. When revised for resubmission, identify all changes made since previous submission.
12. Revisions:
    a. Make revisions required by the Architect.
    b. If the Contractor considers any required revision to be a change, he shall so notify the Architect as provided for in the General Conditions.
    c. Make only those revisions directed or approved by the Architect.
    d. The contractor shall be responsible for delays caused by rejection of inadequate or incorrect submittals.
13. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
14. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
15. Submittals not requested will not be recognized or processed.

B. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
   2. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

3.11 ELECTRONIC DRAWING FILE REQUEST

A. Upon Award of Contract:
   1. At the pre-construction meeting, Awarded Prime Contractor shall bring the executed electronic file release form for the original contract documents. The agreement forms can be found at the end of this Section. Upon the Prime Contractor executing and submitting the agreement to the Architect, the Architect will provide the Contractor one (1) electronic copy of the Revit® BIM Model file(s) **at no charge** within five (5) working days. **Note that CAD files associated with the work can be accessed and exported from the model provided to the General Contractor through the use of Revit® software; therefore, individual CAD files will not be provided by the Architect or its consultants**. Files and Formats to be as follows

a. Civil: Overall master file in AutoCAD format.
   1) Overall site plan with utility and grading information
   2) All details, detail annotation and references are omitted and not part of the AutoCAD file.
b. Structural: BIM Model (Revit) and associated working plan views.
   1) Plan views contain overall and enlarged plan section view set up of foundation, second floor framing and roof framing only. All plan views contain grids, dimensions and general annotation.
   2) All details, detail annotation and references are omitted and not part of the model file.
c. Architectural: BIM Model (Revit) and associated working plan views.
   1) Project Specific BIM Dataset will include information pertaining to the Architectural Building Information Model including model(s), schedules, views, sheets, and details.
   2) All “working” views will be omitted and Huckabee title blocks will be replaced with Huckabee CONTRACTOR Title Block
d. Mechanical, Electrical and Plumbing: BIM Model (Revit) and associated working plan views.
   1) Plan views contain overall and enlarged section plan view set up of mechanical, electrical lighting, electrical power and plumbing plans only.
   2) All details, detail annotation and references are omitted and not part of the model file.
e. Technology: BIM Model (Revit) and associated working plan views.
   1) Plan views contain overall and enlarged section plan view set up showing all device locations and general annotation.
   2) All details, detail annotation and references are omitted and not part of the model file.
   3) Electronic files for Technology drawings will only be released to the Prime Contractor but will require signatures from both the Prime Contractor and the Technology Subcontractor on an additional Technology/Security release form.

2. The Revit® file provided to the Awarded Prime Contractor is NOT FOR CONSTRUCTION PURPOSES, but for convenience only. This BIM Model will consist of the original model utilized for base bid. It is the responsibility of the Awarded Prime Contractor to coordinate all accepted alternates, addenda, Requests for Information, Proposal Requests and any other changes realized during construction. The Architect will not provide up-to-date drawings sets or updated BIM Models to the Awarded Prime Contractor unless otherwise stated within the Owner/Architect agreement. If “conformed” documents are required by the Owner/Architect agreement they will be provided in (PDF) Portable Document Format. Conformed Construction Documents are the Construction Documents modified to include any addenda issued during the bidding or negotiation process. The AIA does not use the terms “conform set” or “conformed set” in its documents.
3. TO THE EXTENT CONFORMED CONSTRUCTION DOCUMENTS ARE PROVIDED TO THE CONTRACTOR REGARDING THE PROJECT, THE FOLLOWING PROVISIONS SHALL APPLY:

a. The Conformed Construction Documents and related information contained therein, are provided for the Contractor's (CONTRACTOR) convenience only, and does not relieve the CONTRACTOR from the requirements of Contract Documents which were issued for bid including any addenda. Specifically, to the extent that any discrepancy or conflict exists between the Issue for Bid documents including any Addenda (collectively referred to as the "Bid and Addenda Documents") on the one hand, and the Conformed Construction Documents on the other, the Bid and Addenda Documents shall control unless otherwise specified in writing by the Architect. Field verification of existing and as-built conditions are required as part of the submittal process as specified in this Section 01 3000 Administrative Requirements and Section 01 7000 Execution and Closeout Requirements.
b. CONTRACTOR shall not to use such drawings, documents, or other data, in whole or in part, for any purpose or project other than the "PROJECT" in the preparation of shop drawings and other submittals.
c. CONTRACTOR acknowledges that such drawings, documents, and other data are subject to change or modification. CONTRACTOR shall be responsible for updating any drawings, documents or other data obtained prior to use by them for any purpose.
d. Any Conformed Construction Documents, including any drawings, documents, or other data related thereto, are provided, "AS IS" without representation or warranty by Architect, either express or implied.
e. CONTRACTOR acknowledges that Conformed Construction Documents are being provided by ARCHITECT as a courtesy to CONTRACTOR, at their specific request, and accordingly CONTRACTOR DOES HEREBY AGREE TO RELEASE, HOLD HARMLESS, DEFEND AND INDEMNIFY ARCHITECT AND THE WILLIS ISD (OWNER), FROM ANY AND ALL CLAIMS, DEMANDS, OR CAUSES OF ACTION, WHICH CONTRACTOR, OR ANY THIRD PARTY, MAY HAVE BY REASON OF ANY INJURY OR DAMAGE SUSTAINED BY CONTRACTOR OR SUCH THIRD PARTTY ARISING OUT OF OR IN ANY WAY RELATED TO THE USE OF SUCH CONFORMED CONSTRUCTION DOCUMENTS.

3.12 PROGRESS PAYMENTS

A. The submission and approval of progress updates and the reports calculating the value of work done for any given pay period for each activity based on the percentage complete for that activity less the amount previously paid for past percentages complete and percent of retainage shall be an integral part and basic element of the application upon which Progress Payments shall be made pursuant to the provisions of the General Conditions and/or Supplementary Conditions. The Contractor shall be entitled to progress payments only as determined from the current updated and approved Construction Schedule. Contractor shall submit (3) three original sets for the first and final applications for payment, with all original signatures of AIA form G702 and G703 (form G702/CMa is not acceptable). All other payment applications shall be submitted electronically as described in paragraph 3.01 Electronic Document Submittal Service.
   1. The initial and subsequent cost reports which are developed from the schedule of values shall include the following activity information:
      a. Activity number and activity description.
      b. Percentage of value of work in place against Total Value.
      c. Total cost of each activity.
      d. Value of work in place this period.
      e. Value of work in place to date.
      f. Value of uncompleted work.
      g. Value of stored material not in place.
      h. The cost report will be submitted as supporting documentation to the Contractor's application for payment. The application for payment shall be submitted as required by the Contract Documents.

i. Identify scopes of work (campuses/buildings) when applicable with a clear and concise heading.
j. Separate scopes of work with the appropriate heading per the 2016 MasterFormat standard.
k. “Description of Work” shall be identified by specification number and heading per 2016 MasterFormat standard while separating the “Labor” and “Material” costs throughout each line item in the scope of Work.
l. Include all associated contingencies and allowances expenditures.
   1) All contingency and allowance expenditures shall be listed sequentially and follow the same guidelines as noted below. “Description of Work” shall reflect the pricing exercise and identify contingency or allowance.
   2) Reference the example AIA Document G703 found at the end of this Section.
m. In the event the Work is completed without the use of 100% of the the associated funds in the contract, column "H" or "Balance to Finish" shall represent the total dollar amount being credited back to the owner via AIA G701

3.13 CONTRACTOR’S DAILY FIELD REPORT

A. Daily reports shall be used to record a chronological, day-to-day account of the work force, the respective activities performed, the weather conditions, and any specific events that take place on the Project.

B. The Daily Report shall not be used as a communication tool. Any situations requiring specific action shall be brought to the attention of the appropriate party by means of written correspondence, memoranda, or meeting minutes.

C. Photographs shall be used with the Daily Report to clarify or confirm statements and concerns.

D. The Contractor shall produce a Daily Report including the following information:
   1. Date.
   2. Weather, temperature, wind, and precipitation.
   3. Number of workers on site, listed by Subcontractor and Trade.
   4. Material and equipment deliveries.
   5. Construction quantities placed.
   6. General description of the Work accomplished.
   7. Specific problems encountered.
   8. Meetings held.
   9. List of visitors to the site and their companies.
   10. Construction photographs.

E. NOTE: Provide Owner with copies of signed Daily Report at weekly progress meetings.

3.14 REQUEST FOR INFORMATION

A. Contract document interpretations or clarifications shall be submitted by the Contractor to the Architect in the form of a written request for information (RFI).

B. RFIs shall be numbered sequentially and shall include only one question or related questions per RFI. If the Contractor’s question or request for interpretation is already clearly defined or discernible in the contract documents, the RFI may be returned unanswered and the Architect may be entitled to additional compensation (from the Contractor) for review time.

C. If the Contractor believes there may be additional contract cost or time incurred, it shall be stated in the RFI. If additional contract cost or time is required based on the RFI, the Architect will issue appropriate documentation for the proposed change. All changes in work shall be accomplished by approved change order only.

D. The Architect will respond to the RFI in a reasonable and timely manner, within approximately seven (7) business days from the date the RFI is received and stamped by the Architect's office. No extension of contract cost or time will be allowed due to a delayed RFI submittal or the response to an RFI.

3.15 DEVELOPMENT OF ADVERSE WEATHER DATA

A. Unless adverse weather data is defined elsewhere in the contract for construction, provide as follows;

B. Collection of Adverse Weather Data
   1. Weather data obtained from the National Oceanic and Atmospheric Administration (NOAA) shall form the baseline for estimating anticipated delays and project durations and determining the occurrence of unusually severe weather. Data shall be collected and compiled as follows:
      a. Contractor shall compile the number of days per month that the anticipated weather is expected to be adverse by analysis of NOAA. The last 5 years of consecutive data shall be used to establish the baseline of rain days per month associated with the project schedule duration. However, in the absence of 5 years of data, a shorter period may be used.
      b. The compiled data shall be submitted with the Contractors Construction Schedule for documenting future weather events.
   2. Adverse Weather is defined as the occurrence of one or more of the following conditions within a twenty-four (24) hour day that prevents the Critical Path of construction activity exposed to weather conditions or access to the site:
      a. Precipitation (rain, snow, or ice) in excess of one-quarter inch (0.25") liquid measure.
      b. Temperatures that do not rise above that required for the day's construction activity, if such temperature requirement is specified or accepted as standard industry practice.
      c. Sustained wind in excess of twenty-five (25) m.p.h.
      d. Contractor shall take into account that certain construction activities are more affected by adverse weather and seasonal conditions than other activities, and that "dry-out" or "mud" days are not eligible to be counted as Weather Delay Day until the standard baseline is exceeded. Hence, Contractor should allow for an appropriate number of additional days associated with the Standard Baseline days in which such applicable construction activities are expected to be prevented and suspended.
   3. A Weather Delay Day may be counted if adverse weather prevents work on the project for fifty percent (50%) or more of the contractor's scheduled work day and Critical Path construction activities were included in the day's schedule, including a weekend day or holiday if Contractor has scheduled construction activity that day.

C. Submission for Time Extension
   1. Although the contractor is required to document the occurrence and effect of adverse weather on the work, it does not relieve the Contractor/Architect of its responsibility to investigate and determine if an excusable delay has occurred.
   2. The schedule of anticipated adverse weather delays included in the contract is established in work days. Similarly, actual weather data should be collected and recorded on a work day basis. Monthly summaries should be maintained indicating actual adverse weather conditions and the impact on work activities.
   3. To determine if any particular month experienced unusually severe weather, the number of actual adverse delay days is compared to that as provided by the NOAA database. If the number of actual delay days is greater than that in the contract the contractor has experienced unusually severe weather.

4. THE DETERMINATION THAT UNUSUALLY SEVERE WEATHER OCCURRED DOES NOT AUTOMATICALLY MEAN THAT THE CONTRACTOR RECEIVES A TIME EXTENSION FOR THE DIFFERENCE OF DAYS BETWEEN THE ANTICIPATED AND ACTUAL ADVERSE WEATHER DELAY DAYS. Further analysis is necessary to determine if the unusually severe weather delayed work activities critical to contract completion. The contractor's progress schedule must be evaluated to make this determination. If it is found that unusually severe weather delayed the contract, a contract modification shall be issued pursuant to Gov. Code 2269
5. Claims for increase in the contract time shall set forth in writing the detail noting the circumstances that form the basis for the claim, the date upon which each cause of delay began to affect the progress of the work, the date upon which each cause of delay ceased to affect the progress of the work and the number of days increase in the contract time claimed as a consequence of each such cause of delay. The Contractor shall bear the entire economic risk of all weather delays and disruptions, and shall not be entitled to any increase in the Contract Price by reason of such delays or disruptions. Requests for an extension of time pursuant to this Subparagraph shall be submitted to the Architect in writing not later than the fifteenth (15th) day of the month following the month during which the delays or disruptions occurred, and shall include documentation demonstrating the nature and duration of the delays or disruptions. Where appropriate, a revised construction schedule indicating all the activities affected by the circumstances shall be included with the documentation.

END OF SECTION

Huckabee

a MORE group brand

ELECTRONIC DOCUMENT RELEASE FORM

Date	

Transmitting Party	Huckabee
Address	
Phone	888.801.6673
Representative	

Receiving Party	
Address	
Phone	
Representative	

Project Name	
Project Number	

This Agreement is made in reference to the electronic drawing plan files for {Recipient} with {Receiving Firm.}

At your request, Huckabee will provide electronic files for your convenience and use in the preparation services performed related to the {Project Name}, subject to the following terms and conditions:

Data contained on these electronic files is part of Huckabee's instruments of service and is confidential and shall not be used by you or anyone else receiving this data through or from you for any purposes other than as a convenience in the preparation of drawings related to your scope of work. These electronic files are not contract documents or accurate record drawings, and significant difference may exist between these electronic files and the actual physical conditions of the facility and/or property.

You agree to assume all liability and risks associated therewith any use of these electronic files in the preparation of contract documents for the new project scope. With the use of these electronic files you agree to the fullest extent permitted by law to hold harmless and indemnify Huckabee and its consultants from and against all claims, liabilities, losses, damages, and costs, including but not limited to attorney's fees, arising there from or in connection therewith. Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by Huckabee, and Huckabee makes no warranties, either expressed or implied for any particular purpose.

100% Sign and Seal 07/07/2026

Copyrights are a form of intellectual property protection provided by federal law. Huckabee expressly retains ownership of all reports, drawings, plans, specifications, electronic files (including CAD/Revit/ BIM models and files), field data, notes and other documents and instruments prepared by Huckabee and/or our Consultant(s) as instruments of service. Huckabee and applicable Consultants shall retain all common law, statutory and other reserved rights, including, without limitation, all copyrights thereto.

We do not mark all documents or digital files with copyright and we are not required to. You are hereby notified that our work (including digital) is protected by copyright, inherently identifying Huckabee as copyright owner and represented by publication date occurrence. This notice clarifies our work shall not be infringed upon by proper notice, disallowing any defendant to claim “innocent infringement.”

File Type:

- ☐ Construction
- ☐ Clash Detection
- ☐ Timeline Simulation
- ☐ Logistics Planning
- ☐ Quantity Extraction / Cost Estimating
- ☐ Shop Drawings
- ☐ Bidding
- ☐ Other

File Format:

- ☐ Revit (.rvt) File Name
- ☐ Navisworks (.nwc/.nwd/.nwf) File Name
- ☐ AutoCAD (.dwg) File Name File Name
- ☐ IFC (enter format type) File Name
- ☐ Design Review (.dwf) File Name
- ☐ Other

Accepted:

_____

Signature and Printed Name of Transmitting Party DATE

_____

Signature and Printed Name of Receiving Party DATE

100% Sign and Seal 07/07/2026

SECTION 013216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

A. Section 01 1000 - Summary of Work.

1.03 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; 2016, with Addendum (2021).

1.04 SUBMITTALS

A. Within 14 days after date established in Notice to Proceed, submit preliminary schedule defining planned operations.

B. If preliminary schedule requires revision after review, submit revised schedule within 7 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

F. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.

G. Submit under transmittal letter form specified in Section 013000 - Administrative Requirements

H. Approval by the Owner and Owner's Representatives of the Contractor's Construction Schedule is advisory only and shall not relieve the Contractor of the responsibility for accomplishing the Work within each and every Contract-required Milestone and Completion date. Omissions and errors in the approved Construction Schedule shall not excuse performance, which is not in compliance with the Contract. Approval by the Owner and Owner's Representatives in no way makes the Owner or Owner's Representatives an insurer of the Construction Schedule's success or liable for time or cost overruns flowing from its shortcomings. The Owner hereby disclaims any obligation or liability by reason of Owner or Owner's Representatives approval of or acquiescence to the Construction Schedule.

I. It is to be expressly understood and agreed by the Contractor that the schedule is an estimate to be revised from time to time as progress proceeds, and that the Owner does not guarantee that Contractor can start work activities on the early or late start dates or complete work activities on the early finish or late finish date shown in the schedule, or as same may be updated or revised; nor does the Owner or Owner's Representative guarantee that Contractor can proceed at all times in the sequence established by said schedule. If Contractor's schedule indicates that Owner or a separate contractor is to perform an activity by a specific date, or within a certain duration, Owner or any separate contractor under contract with Owner shall not be bound to said date or duration unless Owner expressly and specifically agrees, in writing, to same; the Owner's and / or the Owner's Representative's overall review and approval or acceptance of the schedule does not constitute an agreement to specific dates, duration or sequences for activities of the Owner or any separate contractor.

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1.05 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with three years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

B. Contractor's Administrative Personnel: three years minimum experience in using and monitoring CPM schedules on comparable projects.

1.06 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Width required.

C. Sheet Size: Multiples of 8-1/2 x 11 inches.

D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Critical Path Method (CPM) to show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of phases, separate stages or proposed occupancies and other logically grouped activities.

D. Provide sub-schedules for each stage of Work identified in Section 011000 - Summary.

E. Include contract milestone dates and completion dates as specified in the contract.

F. Provide sub-schedules to define critical portions of the entire schedule.

G. Include conferences and meetings in schedule.

H. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

I. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

J. Indicate delivery dates for owner-furnished products and Owner furniture or equipment scheduled for salvage and/or relocation in project.

K. Indicate testing of materials.

L. Indicate activity periods for punch list.

M. Indicate the work to be performed during the facility's scheduled holidays, weekends, or summer recess periods.

N. Coordinate content with schedule of values specified in Section 01 3000.

O. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

C. The schedule diagram shall be a time-scaled drawing.

D. The Construction Schedule Detailed Reports, initial submittal and subsequent updates or revisions, shall indicate each of the following:
   1. Description of activity including activity number/numbers.
   2. Estimated duration time or remaining duration for each activity.
   3. Early start date for each activity.
   4. Late start date for each activity.
   5. Early finish date for each activity.
   6. Late finish date for each activity.
   7. Float available for each path of activities containing float.
   8. Actual start date for each activity begun.
   9. Actual finish date for each activity completed.
   10. Identification of all critical path activities in the mathematical analysis.
   11. The critical path for the Project, with said path of activities being clearly and easily recognizable on the time-scaled graphic diagram, and the relationship between all non-critical activities and activities on the critical path shall be clearly shown on the graphic diagram.
   12. The dollar value of each activity in relation to the schedule of values. This may be shown on a separate cost report.
   13. The responsibility code for the Contractor or Subcontractor performing each activity or portion thereof.
   14. The percentage complete of each activity in progress or complete.

3.04 SCHEDULE OF OFF-SITE ACTIVITIES

A. The Contractor shall include in his Construction Schedule all procurement related activities which lead to the delivery of materials to the site in a timely manner. Upon written approval by the Project Manager, these activities may be submitted as a separate Off-Site Activities Schedule, properly correlated to the Construction Schedule. The schedule of off-site activities shall include, but is not limited to, the following:
   1. Dates for submittals, ordering, manufacturing or fabricating, and delivery of equipment and materials. Long lead items requiring more than one month between ordering and delivery to site shall be clearly noted;
   2. All significant activities to be performed by the Contractor during the fabrication and erection/installation in a Contractor's plant or on a job site, including materials/equipment purchasing, delivery; and
   3. Contractor's drawings and submittals to be prepared and submitted to the architect.

B. The Contractor shall be solely responsible for expediting the delivery of all material to be furnished by him so that the construction progress shall be maintained according to the current schedule for the Work.

C. The Owner's Representatives shall be advised, in writing, by the Contractor whenever it is anticipated by the Contractor that the delivery date of any material and/or equipment furnished by the Contractor for installation will be later than the delivery date shown on the schedule, subject to schedule updates.

D. Submittals, equipment orders and similar items are to be treated as schedule activities, and shall be given appropriate activity numbers.

3.05 FLOAT TIME

A. Float or slack time is defined as the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of an activity or a chain of activities on the Construction Schedule. Float or slack time is not for the exclusive use or benefit of either the Contractor or the Owner. Contractor's work' shall proceed according to early start dates, and the Owner's Representatives shall have the right to reserve and apportion float time according to the needs of the Project. The Contractor acknowledges and agrees that actual delays, affecting paths of activities containing float time, will not have any affect upon Contract completion times, providing that the actual delay does not exceed the float time associated with those activities.

B. Extensions of time for performance as described in the Contract Documents will be granted only to the extent that time adjustment for the activity or activities affected by any condition or event which entitles the Contractor to a time extension exceed the total float or slack along the path of activities affected at the time of Notice to Proceed of a Change Order or the commencement of any delay or condition for which an adjustment is warranted under the Contract Document.

3.06 SCHEDULE UPDATES AND REPORTS

A. Every month, in conjunction with the monthly application for payment, the Contractor shall submit an updated graphic diagram and an updated detailed schedule report from the Construction Schedule and updated Record Documents. Contractors Application for Payment shall not be approved for payment unless schedule is attached and Record Documents are current. The schedule shall be updated to show actual progress and the effect of delays and other events. The actual start and finish dates shall be included in the detailed report, as well as the actual dates of the Milestone events.

B. The content of the updated Construction Schedule shall be equal to that noted in Section 1.02 Construction Schedule.

C. The updated Construction Schedule submitted by Contractor shall not show a completion date later than the Contract Completion Date, subject to any time extensions approved by Owner.

3.07 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 7 days.

3.08 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Update diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effectincluding the effects of changes on schedules of separate contractors.

3.09 RECOVERY SCHEDULE

A. Should the Contractor's Construction Schedule indicate that the progress of the work is behind schedule to the extent that any of the mandatory specific or milestone dates or completion dates are in jeopardy the Contractor shall be required to, at no extra cost to the Owner, prepare and submit to the Owner's Representatives within 72 hours, a Recovery Plan, in a form and detail appropriate to the need and explain and display how he intends to reschedule those activities to regain compliance with the Construction Schedule.

3.10 SCHEDULE REVISIONS

A. Should the Contractor, after approval of the initial Construction Schedule, desire to change his plan in construction, he shall submit his required revisions to the Owner's Representatives along with a written statement of the revisions including a description of the logic for rescheduling the work, methods of maintaining adherence to intermediate Milestones and Specific Dates and the reasons for the revisions. The Contractor shall revise his schedule to include the effect of changes, acts of God, and other conditions or events, which have affected the Schedule. If the requested changes are acceptable to the Owner and Owner's Representatives, the changes will be incorporated into the Construction Schedule in the next reporting period.

B. When the Owner orders changes by change Order which have the potential to impact the Contract Milestones or Specific Dates stipulated in the Supplemental Conditions, a Schedule will be prepared by the Contractor and provided to the Owner's Representatives for concurrence or revision. After the proposed schedule revision has been mutually agreed upon, it will be incorporated into the Construction Schedule. Change Order logic will affect only those activities and performance data directly concerned. Adjustments in Scheduled intermediate Completion Dates or for the Contract as a whole will be considered only to the extent that there is insufficient remaining float to absorb these changes.

C. Any change to the approved Construction Schedule must be approved, in writing, by the Owner and Contractor.

D. Neither the updating or revision of Contractor's Construction Schedule nor the submission, updating, change or revision of any report or schedule submitted to Owner's Representatives by Contractor under this Section nor Owner's review or non-objection of any such report or schedule shall have the effect of amending or modifying, in any way, the Contract Time, any Contract Completion Date, or Contract Milestone Dates or of modifying or limiting in any way Contractor's obligations under this Contract.

3.11 REQUESTED TIME ADJUSTMENT SCHEDULE

A. The updated Construction Schedule submitted by Contractor shall not show a completion date later then the Contract Time, subject to any time extensions approved by Owner:

1. Provided, however, that if Contractor believes he is entitled to an extension of the Contract Time under the Contract Documents, Contractor shall submit to Owner's Representatives, with each progress payment update, a separate schedule analysis (entitled "Requested Time Adjustment Schedule") indicating suggested adjustments in the Contract Time which should, in the opinion of Contractor, be made in accordance with the Contract Documents by time extension, due to changes, delays or conditions occurring during the past month or previously, or which are expected or contemplated by Contractor (whether such conditions are excusable under the Contract or are alleged to be due to Contractor or Owner fault); this separate schedule, if submitted, shall be time-scaled utilizing a computer generated and computer-drawn Schedule analysis schedule, unless otherwise approved by the Owner's Representative and shall be accompanied or preceded by a formal time extension request as required by the Contract and a detailed narrative justifying the time extension requested.

B. The time extension request shall include schedule forecasts that predict the actual Project Completion Date, and any separable portions thereof specified by Owner plus a forecast of the actual achievement of any milestones listed in the Owner-Contractor Agreement.

C. To the extent any time extension requests are ending at the time of any update in the Construction Schedule, the “Requested Time Adjustment Schedule” shall also be updated each month, to reflect any adjustments made by Contractor in the logic, sequence or duration of any activities in the Construction Schedule, or any time extensions previously granted by Owner, and to reflect actual or expected progress, in order that the “Requested Time Adjustment Schedule” shall clearly and accurately reflect Contractor’s Actual intention and proposed time adjustments as of the latest update.

D. Neither the Owner, the Project Manager or the Architect shall have any obligation to consider any time extension request unless the requirements of the Contract Documents, and specifically, but not limited to these requirements, are complied with; and Owner shall not be responsible or liable to Contractor for any constructive acceleration due to failure of Owner to grant time extensions under the Contract Documents should Contractor fail to substantially comply with the submission requirements and the justification requirements of this Contract for time extension requested. Contractor’s failure to perform in accordance with the Construction Schedule shall not be excused, nor be chargeable to Owner, because Contractor has submitted time extension requests or the "Requested Time Adjustment Schedule”.

3.12 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

1.02 RELATED REQUIREMENTS

A. Document 00 3132 - Geotechnical Data

B. Section 01 4516 - Contractor Quality Control. Testing and Inspection services.

C. Section 01 4533 - Code-Required Quality Control.

1.03 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations.

1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract. Contractor, and its Delegated Design Professional, shall be responsible for coordinating with the Design-Related Professional Design Services with the Architect.

B. Base design on performance and/or design criteria indicated in individual specification sections. Design shall be coordinated with and or compatible with all other applicable elements, materials, products, and or components in the Contract Documents.

1. Submit a Request for Information to Architect if the criteria indicated are not sufficient to perform required design services.
2. Submit a Request for Information for any issue necessary to fully and properly coordinate and complete the design in accordance with the Contract Documents.

C. Contractor's Delegated Design Professional shall be responsible for code compliance of all aspects of the Delegated Design whether or not all codes and or their specific code requirements are specifically identified and or called out in the Contract Documents.

D. Contractor shall coordinate with, and obtain written approval from, the Architect for any Delegated Design results that modify the original intent of the Contract Documents regarding occupancy, aesthetics, function, performance, or any design feature.

E. Contractor shall promptly provide written notification to the Architect when Contractor becomes aware of any errors and or omissions regarding the Contractor's professional design services.

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F. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by the Contractor or the Delegated Design Professional. The Architect will review and 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.

G. 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.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures, including but not limited to submittal review responsibilities.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in Texas.
   1. The General Contractor or Construction Manager shall comply with the Texas Professional Services Procurement Act when selecting an Engineer for Delegated Design Services.

1.07 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain, review and comply with copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the Owner, Architect, Contractor or any of their respective subconsultants or subcontractors shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.08 TESTING AND INSPECTION AGENCIES AND SERVICES

A. A Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in specification Section 01 4516 - Contractor's Quality Control and Section 01 4533 - Code-Required Quality Control.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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 manufacturers' instructions conflict with Contract Documents, request clarification from Architect 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. Have work performed 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, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups for each form of construction and finish required, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Integrated Exterior Mock-ups: Construct integrated exterior mock-up. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. See Section 04 2000-Unit Masonry for additional mock-up requirements for field sample panels and integrated envelope and wall assembly.

C. Integrated Room Mock-ups: Construct integrated room mock-ups for one room type of each classroom, office, and restroom. Mock-ups shall include the scope per contract documents along with Owner furnished equipment.

D. Obtain Owner and Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Make corrections as necessary until Owner and Architect's approval is issued.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate beyond the maximum overall allowable tolerance level.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 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 applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
   1. Observer subject to approval of Architect.
   2. Observer subject to approval of Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect and Owner, it is not practical to remove and replace the Work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

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SECTION 014100
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

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. Permits and fees.
   2. Code and regulatory compliance for the associated Work.

C. 2012 TAS - Texas Accessibility Standards; 2012.

D. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

1.02 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements.

1.03 PERMITS AND FEES

A. The Contractor will pay for all City and/or State Building Permits, Impact Fees, and other Building Fees related to the project. The Contractor and Subcontractors will be responsible for obtaining all required trade permits or license fees.

B. Once General Contractor is in possession of the final construction permits (building permits), Contractor shall be responsible for submitting to the AHJ, approved request for pricing (RFP), change orders, or other documents that contain significant changes to the contract until construction is complete. Contractor shall pay for permits or fees associated with any required changes.

1.04 BUILDING CODES

A. Building Code Compliance: Reference drawings for year editions used in document design.
   1. Building Code – International Building Code
   2. Plumbing Code – International Plumbing Code
   3. Mechanical Code – International Mechanical Code
   4. Electrical Code – National Electrical Code
   5. Life Safety Code – NFPA 101

B. Energy Code Compliance
   1. Energy Code – International Energy Code.
   2. Contractor shall provide, at the jobsite office, one copy of the completed energy code review.
   3. Contractor shall hire 3rd Party Energy Code Inspections Firm for all required energy inspections.
      a. Milestones for inspections shall be as follows:
         1) Envelope: Building cladding is substantially complete, windows are delivered and installed, roof insulation has been installed and if possible is visible, interior finish of exterior walls has not been installed so any exterior wall insulation is visible
         2) ME rough-in: Mechanical ductwork is substantially installed, equipment is set, lighting fixtures are installed, ceiling is open (equivalent to an above-ceiling inspection)
         3) Final: Final verification of all mechanical, lighting, controls, envelope as installed and commissioned. Envelope penetrations (e.g. doors, windows) are closed, roof is complete.

C. Accessibility Compliance

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1. Accessibility requirements are from the 2010 ADA Standards for Accessible Design, and the 2012 TAS Texas Accessibility Standards of the Architectural Barriers Act.
2. The information contained in this section is provided to identify the modifications provided for users who are not served by adult standards. It shall be the Contractors responsibility to be familiar with the standards and to apply the standards to all aspects of the project. Any apparent conflict between current standards and the drawings shall be brought to the architect's attention for clarification. The information in the drawings does not release the contractor from full compliance with the latest TAS requirements.
3. Contractor shall provide, at the jobsite office, one copy of the 2012 Texas Accessibility Standard (TAS) regulations as prepared by the Texas Department of Licensing and Regulation, concerning handicap accessibility. The Contractor shall conform to the regulations as set forth in the TAS. Copies can be obtained at Texas Department of Licensing and Regulation, P.O. Box 12157, Austin, TX; 512-539-5669 / Fax 512-539-5690; www.license.state.tx.us. Copies may be downloaded from http://www.license.state.tx.us/ab/abtas.htm.
4. Federal Register:
    a. Vol. 56, No. 144, July 26, 1991, Rules and Regulations; Appendix A to part 36 – Standards for Accessible Design.
    b. 5 U.S.C. 552(a) and 1 C.F.R. part 51, Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Building Elements Designed for Children's Use.
5. Texas Accessibility Standards
    a. The Elimination of Architectural Barriers Texas Government Code, Chapter 469, effective March 15, 2012.

1.05 ACCESSIBILITY REQUIREMENTS

A. General
1. All general TAS standards apply and staff-use areas and spaces for the use of students above the age of 12 shall be designed for adult users. In facilities for younger students, adult-use spaces will commonly be identified by their name (MEN, WOMEN, STAFF TLT, etc). Juvenile-use spaces will be likewise identified (BOYS, GIRLS, STU TLT, etc.).
2. Besides the transition to adult dimensions for students above the age of 12, some requirements vary additionally, depending on age. Refer to the tables enclosed for the varying heights and spacing required.
3. Age/Grade ranges are interpreted as follows:
    a. Ages 3 years and 4 years / Pre-Kindergarten
    b. Ages 5 years thru 8 years / Kindergarten thru 3rd Grade
    c. Ages 9 years thru 12 years / 4th Grade thru 7th Grade
    d. Over 12 years / 8th Grade thru Adult

B. Dimensional Tolerances
1. Contractor is reminded that while the TAS guidelines allow for "construction and manufacturing tolerances" there is no "definition" of what that tolerance is, therefore, where TAS gives a single absolute dimension, every effort should be made to equal that dimension. Where TAS provides a dimensional range, or a minimum or a maximum, there is NO construction tolerance. Any dimension less than the minimum or more than the maximum will be rejected upon inspection and subject to correction.

1.06 QUALITY ASSURANCE

A. Contractor's Designer Qualifications: Refer to Section - 014000 - Quality Requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. Contractor shall note that no regulatory agency designates products with a formal “ADA Approved” designation. Contractor shall be responsible for ensuring all products are reviewed for accessibility compliance.

PART 3 EXECUTION

3.01 REPAIR

A. Non-Compliant Work
   1. The Contractor shall be responsible for removing and correcting all work that is found to be in non-compliance.
   2. The Contractor shall perform all work at no expense to the Owner.
   3. The Contractor shall be responsible to perform all repairs regardless of the date at which the non-compliant items are found.

B. The work shall be performed such that there will be no disruption to the Owner schedule.

END OF SECTION

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SECTION 014339
MOCK-UP WALL CONSTRUCTION

PART 1 – GENERAL

1.01 DESCRIPTION

A. An Building Enclosure Coordination Meeting Pre-construction meeting shall be held with all of the subcontractors responsible for erecting the envelope related materials. Individual pre-construction meetings can be held for the individual trades as needed.
   1. Attendees shall include (but are not limited to): General Contractor, framing and sheathing subcontractor, masonry subcontractor, weather barrier subcontractor, storefront and glazing subcontractor, roofing and sheet metal subcontractors, metal wall panel subcontractors, mechanical and electrical subcontractors, and any other trade that will install products in the exterior building envelope, or penetrate through the exterior envelope. On-site foreman for each trade is required to attend the meeting to ensure the specific coordination items will be communicated to and understood by the person supervising the Work.

B. Work includes: Constructing in-place mock-up, including all reviewed submittals required by the Contract Documents, to establish compliance with the design intent as well as the specified requirements to provide a complete and watertight facility.

C. Providing a photo manifest of as-built conditions as the mock-up is being constructed. Photos shall be kept at the job site during construction for reference. All Photos shall be documented on a plan of the mock up, where they were taken.

D. Mock-up fabrication must be completed and reviewed and approved by the Owner and Architect prior to starting installation of building envelope construction.

1.02 RELATED REQUIREMENTS

A. Individual sections of these specifications for each material indicated for use in the mock-up wall construction.

1.03 SUBMITTALS

A. Section 01 3000 – Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage, etc. as required for items to be installed in the mock-up wall construction.

C. All submittals for materials required in the mock-up walls shall be approved prior to beginning work on the mock-up wall construction.

D. Provide a compatibility matrix of all envelope materials to be used on the project.

E. Provide required test reports for envelope materials.

1.04 PURPOSE

A. The mock-up wall panels are to be constructed as indicated on the drawings, including toothed masonry construction to allow exposed flashings, etc. Construction of the mock-up walls are intended to:
   1. Provide an acceptable quality standard for the completed work.
   2. Identify color and finish selections of the various materials used, as well as the acceptable range of color and variations within those materials.
   3. Establish the required coordination between trades and the sequence of necessary installations to provide a complete and watertight building envelope.

1.05 QUALITY ASSURANCE

A. Coordination of product submittals and construction installation:
   1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted.

2. Verify that each item being submitted is in conformance in all respects with the specified requirements.
3. By affixing the Contractor's signature to each submittal for the mock-up, the contractor certifies that this coordination has been performed.
4. Contractor shall construct the site built mock-up with the same manner of specified construction as the new construction.
5. Contractor shall construct the site built mock-up with the same workmanship and quality as being implemented on the new construction.
6. All material to be installed shall be reviewed by architect and consultants for conformance.

PART 2 – PRODUCTS

2.01 MOCK-UP REQUIREMENTS

A. Build in-place mock-ups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Mock-up wall construction shall be coordinated by the General Contractor and constructed by the subcontractor responsible for the actual construction work. All conditions and materials to be used on the job shall be included in the mock-up. Build mock-ups to comply with the listed requirements, using materials indicated for the completed Work. Construction of mock-up shall be complete 60 days minimum, prior to installation of cladding materilas at the primary structure.

B. Contractor shall start the construction of the mock-up based on, but not limited to, the following list:
1. Foundation if subgrade is present
2. Waterproofing membrane
3. Damproofing material
4. Sheet-Applied Air Barrier Transition Flashing Membrane
5. Metal Through-Wall Flashing
6. Preformed Flashing Pieces
7. Face Brick with Mortar and Weeps
8. CMU with mortar and weeps
9. ICF Wall Systems with Weather Barrier
10. Wall Ties
11. Weather Barrier
12. Portland Cement Plaster
13. Metal Panels, Wall and Soffit
14. Metal Roof Panels
15. Low Slope Roof System
16. Weeps
17. Window Unit with flexible flashing membrane
18. Louver Unit

C. Samples and Manufacturer's Submittals: Submit prior to delivery or installation.
1. Samples of all building system components including all specified accessories.
2. Submit samples of proposed warranties complete with any addenda necessary to meet the warranty requirements as specified.
3. Submit latest edition of manufacturer's specifications and installation procedures. Submit only those items applicable to this project.
4. A written statement from the materials manufacturer approving the installer, specifications and drawings as described and/or shown for this project and stating the intent to guarantee the completed project.
5. Follow submitted shop drawings, product data of all sheet metal.

D. Scale and Measurements: Make Shop Drawings accurately to a scale sufficiently large enough to show all pertinent aspects of the item and its method of connection to the work.

E. Shop Drawings and Product Data: Provide manufacturer's approved details of all conditions, projection conditions, and any additional special job conditions which require details other than indicated in the drawings.
   1. Manufacturer's Details: All termination details and other details normally required by the manufacturer's Technical Specifications, including both standard details and special details, shall be furnished by the Contractor and shall be approved in writing by the manufacturer, the company project manager, and the Owner's representative prior to final installation.

F. Provide manufacturer's approved details, of all perimeter conditions, project conditions, and any additional special job conditions which require details other than indicated in the drawings.

2.02 MANUFACTURER'S LITERATURE

A. Work provided on the mock-up shall follow all of the submitted literature from manufacturers.

B. Manufacturer’s literature shall be the minimum for basis of design and shall be in conjunction with construction documents. All manufacturers' warranties shall remain in effect as specified.

2.03 SAMPLES

A. Provide sample or samples identical to the precise article proposed to be provided.

2.04 COLORS AND PATTERNS

A. Unless the precise color and pattern are 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/Project Manager for selection in advance of the Envelope Pre-Construction meeting.

B. Contractor shall coordinate with Architect for exact layout or design of patterns and textures and how they are to be installed on the mock-up.

PART 3 – EXECUTION

3.01 ENVELOPE PRE-CONSTRUCTION MEETING

A. Begin construction of mock-up wall prior to envelope pre-construction meeting, at location determined by Architect. Progress should be sufficient to review installation of air barrier and flashings as part of envelope pre-construction meeting.

B. Convene a minimum of one week prior to initiation of the mock-up wall construction. Size and location of in-place mock-up to be determined at this meeting.

C. Verify that all required submittals have been approved and that color/finish selections have been made.

D. Establish coordination between trades and establish sequencing of material installations to ensure a complete and watertight assembly.

E. Distribute meeting minutes and agreed upon sequencing to all subcontractors.

F. Construct mock-up walls in accordance with the established procedures and installation sequencing.

3.02 INSTALLATION OF MATERIALS

A. Contractor shall install all materials on mock-up in same manner required for the main structure. Refer to specification sections for basis of design of all material being installed on this mock-up.

B. During installation, Contractor shall maintain a photo manifest of mock-up construction for Architect and Owner to review.

C. Quality of installation is of utmost importance and shall be monitored for completeness and conformance with the design intent and manufacturer's installation recommendations.

D. Once mock-up is complete, it shall be reviewed by the Architect and Owner's Representative for conformance to construction documents.

E. Contractor shall install material in same sequencing as required by industry standards.

3.03 INSTALLATION OF WINDOWS AND ASSOCIATED FLASHING

A. Installer shall coordinate the installation of the window with associated trades to maintain proper compatibility of material.

B. Installation shall be in accordance with referenced specifications.

C. Install all perimeters flashing as detailed to create a sealed air and watertight condition.

D. Once window flashing and weather barrier have been installed, but prior to the installation of cladding, Contractor shall notify Architect, Owner and Consultants for review for conformance and shall coordinate a water test of surrounding flashings per section 01 4000 and Division 08. Contractor shall notify Architect, Owner and Consultants to observe the testing. All tests shall be in accordance with referenced specifications.

3.04 INSTALLATION OF FLASHING AT THROUGH-WALL LOCATION

A. Installer shall coordinate the installation of the wall flashing with associated trades to maintain proper compatibility of material.

B. Installation shall be in accordance with referencing specifications.

C. Once flashing has been installed, Contractor shall notify Architect, Owner and Consultants for review for conformance.

3.05 QUALITY ASSURANCE

A. Air Barriers
   1. Conduct wet film thickness readings throughout application of the membrane to confirm compliance with manufacturers requirements. Maintain a wet film thickness log for documentation.
   2. Conduct dry mil testing on the on the mock-up as well as on the air barrier installation. Each sample will consist of at least 1" X 1" sample of cured fluid applied air barrier membrane and is taken at no less than one location per elevation. If visible variations are noted, more samples may be taken to allow a reasonable distribution.
   3. At transitions between materials provided by different manufacturers provide adhesion testing of the air/weather barrier by a third party agency per ASTM D4541, *Test Method for Pull-off Strength for Coatings Using Portable Adhesion Testers* at a minimum of (1) location for each transition condition;
      a. The manufacturer shall provide the minimum pull off strength in pounds per square inch (psi). In the event that the manufacturer cannot provide this data, the minimum pull off strength considered "passing' shall be 100 pounds per square inch.

B. Sealant Joints
   1. Exterior sealnt joints are to be no less tan 1/2" wide.
   2. Provide sealant adhesion testing, with and without primer, at various substrate conditions, as required by the specifications and/or manufacturer's instructions included as part of the product submittals.
   3. Submit report to Architect.

C. Glazing Systems
   1. Provide specified testing of the exterior glazing systems by a third party testing agency in accordance with the ASTM standards to verify quality of installed systems and system performance. Provide minimum of one (1) test per each per section 01 4000 and Division 08. In the event multiple tests are specified, the most stringent test shall be required at the mock-up condition.

3.06 CONSTRUCTION SCHEDULE

A. Once installation sequences have been determined and mock-up wall construction has been approved, modify the Construction Schedule to reflect the established sequencing of material installations and testing requirements. Distribute revised schedule.

END OF SECTION

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SECTION 014516
CONTRACTOR'S QUALITY CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control of installation.

B. Testing and inspection services by one or more quality assurance laboratories to be employed by the Contractor (if these services are not provided by subcontractors or material suppliers). The purpose of quality assurance services are so that the Contractor can verify work is done properly during construction, before the Contractor requests that the Owner's Independent Quality Control Agency performs code-required special inspections, tests and structural observations. The Contractor's QA Laboratory testing and inspection services shall include, but not be limited to:
   1. Testing, inspection, and certifications specified in sections of Project Manual other than Section 01 4533. This quality assurance testing shall be paid by the Contractor.
   2. Earthwork borrow pit material verification
   3. Concrete mix design verification
   4. Masonry unit compressive strength verification
   5. Structural Steel quality assurance recommended by AISC
   6. HVAC Testing and Balancing
   7. Indoor Air Quality Testing
   8. Certification of No Asbestos Containing Materials

C. References and standards.

D. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

A. Document 00 3132 - Geotechnical Data

B. Section 013000 - Administrative Requirements: Submittal procedures.

C. Section 01 4000 - Quality Requirements

D. Section 01 4533 - Code Required Quality Control

E. Section 016000 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).

B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2014a.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.

G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

1.04 QUALITY ASSURANCE (OF CONTRACTOR'S QUALITY ASSURANCE LABORATORY)

A. Contractor's QA Laboratory Qualifications and Procedures:

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1. Meet "Recommended Requirements for Independent Laboratory Qualification," latest edition published by American Council of Independent Laboratories. Testing agencies shall meet the requirements of ASTM E 329, "Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as Used in Construction" and ASTM E 543, "Determining the Qualification of Nondestructive Testing Agencies."
2. The inspection and testing services of the testing agency shall be under the direction of a Registered Engineer licensed in the State of Texas, charged with engineering managerial responsibility, and having at least five years engineering experience in inspection and testing of construction materials.
3. Inspecting personnel monitoring concrete work shall be ACI certified inspectors.
4. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection. Include memorandum of remedies of deficiencies reported by this inspection.
5. Testing Equipment: Calibrated at reasonable intervals by devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
6. Tests and inspections shall be conducted in accordance with specified requirements and if not specified, in accordance with applicable standards of the American Society for Testing and Materials and other recognized authorities as approved.
7. Primary inspectors performing structural steel inspection shall be currently certified AWS Certified Welding Inspectors (CWI), in accordance with the provisions of AWS QCI, "Standard and Guide for Qualification and Certification of Welding Inspectors." The inspector may be supported by assistant inspectors who may perform specific inspection functions under the supervision of the inspector. Assistant inspectors shall be currently certified AWS Certified Associate Welding Inspectors (CAWI). The work of assistant inspectors shall be regularly monitored by the inspector, generally on a daily basis.

1.05 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference 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 of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. See Section 01 4000 - Quality Requirements

3.02 GENERAL REQUIREMENTS FOR CONTRACTOR'S LABORATORY SERVICES

A. The Contractor shall perform various tests as required in the various specification sections for conference to the construction documents other than those in Section 01 4533. The Owner maintains the right to verify the test results with an independent testing lab.

B. Contractor’s design testing and certification testing includes:

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1. Testing defined in this Specification Section.
2. Testing when source of material is changed after initial tests have been performed.
3. Other testing required by other Sections of the Specifications.

3.03 EARTHWORK

A. Earthwork: Identify suitable material at borrow material location, sampling soil material, and testing of soil material samples.

3.04 CONCRETE

A. Furnish concrete mix designs, in accordance with ACI 301, Section 3.9, made by an independent testing laboratory or qualified concrete supplier. Where mix designs by an independent testing laboratory are required, the laboratory shall be selected by the Contractor, approved by the Architect, and paid by the Contractor.

3.05 MASONRY

A. Furnish laboratory testing from the manufacturer or a Contractor-hired laboratory that verifies the compressive strengths of masonry units comply with specifications.

B. Absorption Tests:
   1. Perform a field of test for water absorption on three representative clay units and at least once for each 5,000 square feet of wall before laying.
   2. The field test shall consist of drawing a one inch diameter circle with a wax pencil (the diameter of a quarter). Place thirty (30) drops of water from a medicine dropper in rapid succession with the circle. If all of the water is absorbed into the brick in less than 60 seconds, the units shall be deemed "to dry" and shall be prewetted.

3.06 STRUCTURAL STEEL

A. Provide current welder certifications for each welder to be employed.

B. Performing certified welding procedure qualification and re-qualification testing specified in Section 05 1200, 05 2100, 05 3100, 05 4000, 05 4400, 05 5000 and 13 3419 and as recommended by the American Welding Society.

C. Testing of materials when mill certificates are unavailable.

3.07 HVAC TESTING AND BALANCING

A. The Contractor shall provide complete testing and balancing services for all HVAC and control systems to be carried out by an independent certified testing and balancing (TAB) agency under a separate and direct contract with the General Contractor. Scope of testing and balancing services, Contractor obligations, etc. shall be in accordance with Testing, Balancing and Commissioning specification section.

3.08 INDOOR AIR QUALITY TESTING

A. The Contractor shall provide complete air quality testing services for the project to be carried out by an independent certified agency under a separate and direct contract with the General Contractor. Scope of testing services, Contractor obligations, etc. shall be in accordance with Section 01 5719 – Indoor Air Quality Requirements.

3.09 CERTIFICATION OF NO ASBESTOS CONTAINING MATERIAL

A. The Contractor shall provide the Architect a written certification of the following;
   1. Hazardous material-free construction – certify that no asbestos containing material was used and/or incorporated into the project during construction.
   2. The statement shall be as follows:

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a. The undersigned, pursuant to the General and Supplementary Conditions of the Contract for Construction, hereby certifies that to the best of his/her knowledge, information and belief, the materials incorporated into the project and as used during the construction process are free of any type of asbestos material, lead, polychlorinated biphenyl (PCB) or other materials identified by governmental agencies as being hazardous.

3.10 MANUFACTURERS' FIELD SERVICES

A. See Section 01 4000 - Quality Requirements

3.11 DEFECT ASSESSMENT:

A. See Section 01 4000 - Quality Requirements

END OF SECTION

SECTION 014533
CODE-REQUIRED QUALITY CONTROL

PART 1 GENERAL

1.01 IMPORTANT NOTE FOR ALL PLAN REVIEWERS (AHJ) TO READ BEFORE ISSUING A BUILDING PERMIT!

A. This Section (Specification Section 01 4533) is the "Statement of Special Inspections, Testing, Structural Observations and Commissioning" for this project and is hereby submitted to the building official for review and approval. This statement has been prepared collaboratively by the Architect and appropriate Design Professionals such that the registered design professional responsible for the design of each portion of the work considered the requirements of Chapter 17 of the International Building Code (IBC), considered the Commissioning requirements of the International Energy Conservation Code, considered the nature of the work, and then customized this statement specifically for this project based on their professional opinion of what they recommend for the code-required quality control plan. In some instances, the special inspections, testing and/or structural observation required by this statement are significantly less than the special inspections, testing and/or structural observations that would be required by the IBC without Exception #1 in IBC Section 1704.2 which states special inspections, tests, and/or structural observations are not required for construction as warranted by conditions in the jurisdiction as approved by the building official. This customized quality control plan also includes some variations from procedures required by IBC Chapter 17, such as submitting certain items to Registered Design Professionals in lieu of the AHJ; these variations are based on procedures that AHJ's have indicated are preferred and also the experience of the Registered Design Professionals which indicates that this quality control plan (including these procedural variations) will meet or exceed the local standard of care. It is our understanding that the AHJ has the authority to allow these procedural variations on code-required quality control because the AHJ has the authority to waive the entire quality control plan under Exception #1 in IBC Section 1704.2. According to IBC Section 105.3.1, "If the application or the construction documents do not conform to the requirements of pertinent laws, the building official shall reject such application in writing, stating the reasons therefor. If the building official is satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto, the building official shall issue a permit therefor as soon as practicable." Therefore, if a building permit is issued without written notification that this statement or a portion thereof is rejected, it will be understood that this Statement of Special Inspections, Testing, Structural Observations and Commissioning is acceptable in the opinion of the building official, who has the authority to render interpretations of the code according to IBC Section 104. For clarification, this Statement includes the information required by IBC Section 1704.5 to be submitted to the AHJ before commencement of structural observations.

B. Chapter 17 of the International Building Code requires that the AHJ approve Special Inspection and Testing Agency (SITA) staff qualifications and requires that discrepancies identified during construction be resolved in order to comply with the building code. Based on Huckabee's experience with numerous AHJ's, it is understood that, instead of the AHJ directly reviewing these qualifications and resolutions, it is acceptable to the AHJ for Registered Design Professionals to determine whether or not SITA staff qualifications are acceptable and determine what resolutions to discrepancies identified during construction comply with the building code, without soliciting the opinion of the AHJ. And, for clarification, some discrepancies that occur during construction often include scenarios in which the specified scope for a quality control agency was not performed due to the Owner not hiring an agency to do some portion of the scope, inaction by the Contractor, inaction by the hired quality control agency or a miscommunication between parties. Therefore, it shall be considered acceptable for the Registered Design Professionals for each respective design discipline to be considered the sole determinant of acceptable quality control agency qualifications and resolutions of discrepancies and not report these details to the AHJ, if a building permit is issued without written notification that this understanding is incorrect.

1.02 OWNER-PREPARED DOCUMENTS

A. Sections 01 1400 and 01 4533 require that the Owner participate in the preparation of certain documents (e.g. Owner Agreement with the SITA) before critical construction schedule milestones. Proposers shall assume for proposal purposes that the Owner will provide these documents or provide all necessary participation of these documents without causing a delay to the construction schedule. However, the Contractor shall notify the Owner in writing 45 days before such a document is necessary to avoid a delay, notifying the Owner in writing of the deadline necessary to avoid a delay.

1.03 REQUIREMENTS FOR QUALITY CONTROL

A. Requirements for Quality Control:
   1. Special inspections and testing services shall be provided by an agency to be selected and employed by the Owner, which is referred to herein as the Special Inspection and Testing Agency (SITA). The SITA may subcontract other firms to provide quality control services on behalf of the SITA as necessary; however, the SITA shall be responsible for providing directly or indirectly all of the SITA responsibilities defined in Section 01 4533.
   2. Commissioning services shall be performed by the Commissioning Agent (CxA) as specified in Division 01 and Divisions 22-26.
   3. As a general part of the Code-Required quality control plan, Design Professionals shall be notified at appropriate times and allowed to make site visits and visual observations for general conformance with the contract documents.
   4. It shall not be required to notify and obtain approval from the AHJ if alternative arrangements are made in hiring firm(s) to provide quality assurance services (e.g. Owner hiring multiple firms, Architect acting as the Owner’s Agent and hiring the SITA, Owner hiring the Structural Observer, etc…)
   5. Each type of quality control service shall be considered separate from every other type of quality control service. The services by one quality control firm do not relieve the responsibility of the other quality control firm to provide their quality control services.

1.04 RELATED REQUIREMENTS

A. Document 00 3132 - Geotechnical Data

B. Section 01 1400 - Work Restrictions: Work restrictions related to quality assurance.

C. Section 01 3000 - Administrative Requirements: Submittal procedures.

D. Section 01 4000 - Quality Requirements.

1.05 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): The agency or individual officially empowered to enforce the building, fire and life safety code requirements of the permitting jurisdiction in which the Project is located. Where the term "building official" is used, it shall refer to the AHJ

B. Code or Building Code: 2015 Edition of the International Building Code and documents referenced by that document.

C. Commissioning Agent (CxA): The agent specified to perform the Commissioning specified in Division 01 and Divisions 22-26.

D. Design Professionals: For the purposes of Section 01 4533, the term “Design Professionals” shall refer to every Design Professional responsible for the design, or making recommendations regarding the design, of any portion of the project, including but not limited to the Geotechnical Engineer, professionals that sealed drawings on the Contract Documents, as well as any professionals hired by the Contractor. (Examples on some projects may be the Geotechnical Engineer, Architect, Civil Engineer, Structural Engineer, Mechanical Engineer, Electrical Engineer, Contractor’s Cold Formed Metal Framing Engineer, Contractor’s Pre-Manufactured Canopy Engineer, Contractor’s Pre-Engineered Metal Building Engineer, Contractor’s Precast Concrete Engineer, etc…)

E. Special Inspection and Testing Agency (SITA): The agencies responsible for providing all required special inspections and testing defined by Section 01 4533.
   1. Where used in the contract documents, the following terms (if used) shall also refer to the Special Inspection and Testing Agency (SITA):
      a. "Special Inspection Agency"
      b. "Construction Materials Engineering Firm"
      c. "Construction Materials Testing Firm"
      d. "Owner's Testing Laboratory"
      e. "Independent Testing Laboratory"

F. Special Inspections and Tests: The Special Inspections and Tests for this project are the inspections and tests required by Section 01 4533. These special inspections and tests are independent of any inspections and tests conducted directly by Willis ISD or Contractor.

G. Quality control observations: For the purposes of Section 01 4533, the term “quality control observations” shall refer to the observations by the following quality control personnel:
   1. CxA
   2. Design Professionals

H. Quality control observers: For the purposes of Section 01 4533, the term “quality control observers” shall refer to the personnel acting on behalf of the firms providing quality control observations.

I. Quality control personnel: For the purposes of Section 01 4533, the term “quality control personnel” shall refer to the personnel acting on behalf of the following as they perform quality control services associated with Section 01 4533:
   1. SITA
   2. CxA
   3. Design Professionals

J. Quality control services: For the purposes of Section 01 4533, the term “quality control services” shall refer to the services required by Section 01 4533 to be performed by the quality control personnel.

1.06 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary ; 2011.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement ; 2015.

C. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field ; 2012.

D. ASTM C172/C172M - Standard Practice for Sampling Freshly Mixed Concrete ; 2010.

E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel ; 2008.

F. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel ; 2011.

G. IAS AC89 - Accreditation Criteria for Testing Laboratories ; 2010.

H. IAS AC291 - Accreditation Criteria for Special Inspection Agencies ; 2012.

I. AASHTO R18 - Accreditation for Materials Testing Laboratories

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1.07 APPROVAL OF SITA QUALIFICATIONS AND SCOPE

A. SITA Qualifications: Before performing any SITA services on this project, the SITA shall submit to the Architect a statement for approval by the Architect indicating that the SITA firm and SITA Staff that will be assigned to this project will meet the following qualifications. The SITA shall indicate the years of experience performing similar work if a listed certification is not held by any proposed personnel (e.g. “We will only assign staff to this project that meets the listed certifications in Section 01 4533 with the exception that our masonry inspection and testing personnel have at least 10 years of experience performing masonry inspection and testing on similar projects but do not have a TMS Certification”):

1. It shall be required that the Special Inspections and Testing Agency (SITA) be accredited by IAS according to IAS AC291 and IAS AC89, or be accredited by AASHTO (or AMRL) unless the SITA obtains written approval of their experience performing inspection and testing services on similar projects by the Architect.
2. It shall be required that the Construction Materials Engineer be a Professional Engineer with Construction Materials Engineering experience that is licensed in the State of Texas.
3. It shall be required that the Concrete Inspection Technicians be at least certified ACI (American Concrete Institute) Concrete Field Testing Technicians-Level I, unless the SITA obtains written approval of the technician's experience performing concrete inspection services on similar projects by the Structural Engineer.
4. It shall be required that the Concrete Testing Technicians be at least certified ACI (American Concrete Institute) Concrete Laboratory Testing Technicians-Level I, unless the SITA obtains written approval of the technician's experience performing concrete testing services on similar projects by the Structural Engineer.
5. It shall be required that the Masonry Inspection Technicians be at least certified International Code Council (ICC) Structural Masonry Special Inspector unless the SITA obtains written approval of the technician's experience performing masonry inspection services on similar projects by the Structural Engineer.
6. It shall be required that the Masonry Testing Technicians be at least certified International Code Council (ICC) Structural Masonry Special Inspector unless the SITA obtains written approval of the technician's experience performing masonry testing services on similar projects by the Structural Engineer.
7. It shall be required that the Steel Inspection and Testing Technicians (for both Structural Steel Framing as well as Cold Formed Metal Framing) be certified Associate Welding Inspectors as defined by AWS (American Welding Society) or have a higher certification by AWS unless the SITA obtains written approval of their experience performing inspection and testing services on similar projects by the Structural Engineer.
    a. Steel Inspection Technicians shall have passed within the last 2 years an eye examination with or without corrective lenses to verify the Technician has near vision acuity of Snellen English or equivalent at no less than 12 inches, and far vision acuity of 20/40 or better.
    b. Steel Inspection Technicians inspecting bolts shall have a minimum 2 years of experience inspecting bolts as part of regular inspections of structural steel systems.
    c. Steel Testing Technicians performing non-destructive testing of welds other than visual shall be certified NDT Level II Technicians in accordance with the American Society for Nondestructive Testing Recommended Practice No. SNT-TC-1A.

8. It shall be required that the Technician providing special inspection services regarding firestopping at penetrations and joints be an IFC-Certified Inspector with a complete certificate indicating that the technician has passed the online exam and has complete the hands-on product training from at least four (4) firestop product manufacturers, or have written approval by the Architect of experience performing similar inspection services. It shall be permitted for “similar inspection” to be inspection of sprayed fire-resistant material if this experience is supplemented by a certificate or card indicating the technician has completed manufacturer’s training on the firestopping material submitted and approved for use on this project.

B. SITA Scope: Before performing any SITA services on this project, the SITA shall submit to the Architect a statement (e.g. a copy of a fully executed agreement between the Owner and the SITA, or an email from the Construction Materials Engineer to the Architect) for approval by the Architect, indicating that the SITA will perform all work specified in Section 01 4533 to be performed by the SITA. An example of an acceptable statement is, “Our firm will provide all work specified in Section 01 4533 to be performed by the SITA for the [insert project name] located at [insert project address], Huckabee project number [insert project number].”

C. It shall be permitted for the SITA to provide one statement regarding both qualifications and scope.

1.08 APPROVAL OF CXA QUALIFICATIONS AND SCOPE

A. CxA Qualifications: Before performing any CxA services on this project, the CxA shall submit to the Mechanical and Electrical Engineers a statement for approval by the Mechanical and Electrical Engineers indicating that the CxA firm and CxA Staff that will be assigned to this project will meet the qualifications required by Division 01 and Divisions 22-26.

B. CxA Scope: Before performing any CxA services on this project, the CxA shall submit to the Mechanical and Electrical Engineers a statement (e.g. a copy of a fully executed agreement, or an email from the CxA) for approval by the Mechanical and Electrical Engineers, indicating that the CxA will perform all work specified in Division 01, Section 01 4533 and Divisions 22-26 to be performed by the CxA. An example of an acceptable statement is, “Our firm will provide all work specified in Division 01, Section 01 4533 and Divisions 22-26 to be performed by the CxA for the [insert project name] located at [insert project address], Huckabee project number [insert project number].”

C. It shall be permitted for the CxA to provide one statement regarding both qualifications and scope.

1.09 CONTRACTOR’S GENERAL RESPONSIBILITIES

A. It shall be the Contractor’s sole responsibility to comply with all requirements of the Contract Documents, without relying on any of the quality control services required by Section 01 4533. The purpose of quality control services is to simply provide some verification that the Contractor is complying with the Contract Documents.

B. As required by the International Building Code, the Contractor shall submit to Willis ISD, the Building Official (AHJ), and the Architect a written "Acknowledgement of Contractor's Responsibilities Related to Code-Required Quality Control".

1. This statement shall identify this project as " Project Title", including Architect's project number.
2. The statement shall either include the following language or similar language: "As the Construction Firm responsible for the construction of this project, we acknowledge that we are aware of all the requirements of Specification Sections 01 1400 and 01 4533. In addition, we acknowledge that all firms currently under contract as Subcontractors to our firm on this project are also aware of the requirements of Specification Sections 01 1400 and 01 4533. We further acknowledge that we will make any firms we contract with in the future for this project also aware of these requirements prior to commencement of their scope of work."

C. If any steel fabrication occurs off-site (at a fabrication shop) that is not an AISC certified fabrication shop, the Steel Fabricator shall pay for the SITA to perform the special inspections or testing required by Section 01 4533 for all such off-site steel fabrication.

D. The Contractor shall notify quality control personnel at least five (5) business days before they need to visit the site to perform their services. In addition, the Contractor shall cooperate with quality control personnel, provide incidental labor, equipment and facilities to give them access to the work (including ladders and lifts), and provide space onsite for their operations and storage.
   1. If the Contractor does not request quality control services where required, the work that was not inspected and/or tested shall be considered deficient and the Contractor shall issue an RFI to the Architect immediately when the Contractor becomes aware of this deficiency.

E. The Contractor shall make accessible and visible all work requiring quality control services until all deficiencies are corrected or otherwise fully addressed.

F. Addressing Deficiencies in SITA Reports: The Contractor shall fully address all deficiencies noted by the SITA and notify the SITA when and how each deficiency was addressed. It shall be permitted to either correct the work in the presence of the SITA, provide evidence to the SITA that there was in fact no deficiency if that is the case, provide evidence to the SITA that the appropriate Design Professional(s) have determined that the deficiency from the contract documents is acceptable, or provide evidence to the quality control entity (e.g. SITA, CxA, or the respective design professional) that a remediation plan was approved by the appropriate Design Professional(s) and then constructed.

G. Addressing Quality Control Observations:
   1. The Contractor shall be responsible for addressing any observations verbally noted by Design Professionals during site visits as if these observations were noted in writing. If the Contractor would like a written record of those observations, the Contractor shall submit a record of their understanding of the conversation to the Architect and Design Professional.
   2. The Contractor shall be responsible for determining if any observations identify or provide evidence of any deficiencies (discrepancies from the contract documents).
   3. All deficiencies associated with observations by Design Professionals shall be addressed by the Contractor.
   4. Except for items noted by a Design Professional that are identified in an observation report as “registered”, the Contractor is not required to notify the Design Professional when deficiencies that are associated with observations by Design Professionals have been addressed in good faith by the Contractor. It shall be acceptable for the Contractor to address such items by correcting the discrepancy from the contract documents or determining that a deficiency does not in fact exist. Alternatively, it shall also be acceptable for the Contractor to issue an RFI proposing acceptance of the deficiency or a remediation, and then remediating if approved.
      a. If the Design Professional requests at any time written correspondence that the Contractor has addressed deficiencies associated with any or all observations, the Contractor shall determine whether or not such deficiencies were addressed, resolve any deficiencies that were in fact not yet addressed, and then provide written correspondence indicating that all deficiencies associated with observations by the Design Professional have been corrected when all deficiencies have been corrected.

5. The Contractor shall correct or otherwise fully address all items noted by Design Professionals that are identified in an observation report as “registered”. After registered items have been corrected or otherwise fully addressed but before the Contractor is permitted to install construction which obstructs view of the correction or noted condition, the Contractor shall submit to the Design Professional acceptable evidence of how the item was addressed. The Design Professional shall be the sole determinant of what is considered acceptable evidence and the Design Professional may require a follow-up site visit to make observations. Examples of acceptable evidence might be a photograph emailed by the Contractor, a report from the SITA, or a conversation with the Architect’s representative.

H. If deficiencies are brought to the Contractor’s attention by quality control personnel, the Contractor shall issue a Request For Information (RFI) to the Architect if direction is needed to resolve the item. This RFI shall include the Contractor's suggested course of action to address the deficiency. Unless the Contractor completely removes nonconforming work and replaces it with conforming work, it is the Contractor's responsibility to hire design professionals as required to design any remediation preferred by the Contractor, to be submitted to the Architect for consideration. This RFI may also include a request for acceptance of the deficiency based on an evaluation by the appropriate project design professional(s) such as the Structural Engineer of Record. The entire cost and schedule impact of any deficiencies identified by inspections and/or tests shall completely be the responsibility of the Contractor, at no additional cost to Willis ISD. Willis ISD reserves the right to assess liquidated damages associated with any and all delays due to addressing deficiencies.
   1. If the Contractor would like Design Professional(s) such as the Structural Engineer of Record to design a remediation in lieu of the Contractor hiring design professionals, it shall be permitted for the Contractor to make this request in the RFI. However, project design professional(s) shall have no obligation to design any remediation and shall be permitted to charge for design services. The Contractor shall provide a deadline for the requested design in the RFI, or it may be assumed that the schedule of this resolution is not time-sensitive. If the project design professional(s) do not produce an approved remediation design by this deadline (even if there is no response to the RFI), the Contractor shall either remove nonconforming work and replace it with conforming work or hire design professionals to design a preferred remediation to be submitted for consideration by the Architect. The Contractor shall be responsible for any delays due to attempts by project design professional(s) to design remediation’s by the requested deadline.

I. The Contractor shall pay for all re-inspections and re-tests performed after quality control personnel have identified deficiencies, regardless of who is paying for the basic quality control services. The Contractor shall also pay for any tests, inspections and/or observations not required by Section 01 4533 but requested by the Contractor.

J. The Contractor shall be responsible for paying (either directly or by reimbursing the Owner or Architect) for all additional services by quality control personnel associated with addressing deficiencies.
   1. Design Professionals shall be permitted to bill the Contractor at their standard hourly rates and it shall be the Contractor’s responsibility to realize that the Contractor shall be responsible for paying for any time a Design Professional spends performing additional services such as responding to RFI’s regarding deficiencies, attending meetings regarding deficiencies, making site visits to address deficiencies.
   2. In general, many Design Professionals do not charge for these services; however, on this project, Design Professionals shall be permitted to bill or not bill the Contractor at their discretion and the Contractor shall be required to pay all such bills.

3. Design Professionals are not obligated to inform the Contractor in advance what that Design Professional's standard hourly rates are or how much time will be spent or even whether or not that Design Professional intends to submit a bill; the Contractor shall be obligated to ask Design Professionals how much time a task may take and otherwise keep track of these items if the Contractor desires to consider hiring a different Design Professional to assist them in addressing deficiencies.
4. These additional services are often short duration items scattered over a long period of time; the Design Professionals shall be permitted to send the Contractor a bill for all services associated with addressing deficiencies at the end of the project before a Certificate of Final Completion is issued. The Owner shall be permitted to pay for these services out of the Contractor's Retainage.

1.10 SITA'S GENERAL DUTIES AND RESPONSIBILITIES

A. Role: The Special Inspection and Testing Agency (SITA) shall provide Construction Materials Engineering services, with a Construction Materials Engineer that directly supervises all SITA responsibilities and evaluates whether or not reports from inspections and/or tests conform with construction requirements in the drawings and specifications related to the specific inspections and/or tests required by Section 01 4533.
   1. It shall be the Contractor's sole responsibility to comply with all requirements of the Contract Documents, without relying on any of these quality control services. The purpose of the quality control services provided by the SITA is to simply provide some verification that the Contractor is complying with the Contract Documents.
   2. For clarification, acting under the supervision of the SITA's Construction Materials Engineer, the SITA's personnel shall be permitted to use judgment and experience when measuring dimensions and locations of elements where required by this specification section, to verify conformance with the design intent rather than measuring all instances. For example, where Section 01 4533 requires that the SITA verify locations and or dimensions of all elements for a certain type of construction, it shall be acceptable for the SITA personnel to field measure only a fraction of those dimensions (e.g. "random sampling") when non-measured conditions visually appear to conform, measuring at a frequency determined by the SITA to be appropriate using judgment and experience (rather than field measuring every dimension). Furthermore, the SITA may increase or decrease the frequency of these field measurements depending on how often deficiencies are encountered.
   3. The SITA shall not be permitted to release, revoke, alter, or enlarge on any requirements of Contract Documents; approve or accept any portion of the work; or, assume any duties of the Contractor. The SITA shall not have the authority to stop the work.

B. Contractor's Work Restrictions: The Work Restrictions in Section 01 1400 related to Quality Control require that the Contractor obtain certain documents from the SITA and host certain meeting that the SITA attends, before certain construction milestones for the project to proceed. The SITA shall cooperate with the Contractor, providing those items and attending those meetings within a reasonable time frame.

C. Pre-Construction Meetings: The SITA shall participate (in person or on the phone) at the Foundation Pre-Construction Meeting, Quality Control Pre-Construction Meeting, and Framing Pre-Construction Meeting.

D. SITA Reports: After each special inspection or test, the SITA shall issue a report electronically to the Architect, Contractor, and the Design Professional requiring the report (e.g. concrete cylinder test reports for the foundation shall be submitted to the Structural Engineer), and anyone else the Architect indicates should be included in the distribution (e.g. AHJ, Owner, Construction Observer, etc…). These reports shall include the project title and number and information deemed appropriate by the Construction Materials Engineer.

E. Addressing Deficiencies:

1. The SITA shall notify the Architect, Contractor and the Design Professional requiring the quality control, of observed deficiencies or non-conformance of work or products.
   a. A draft report of any deficiencies noted during inspections shall be provided to the Contractor on-site in writing (using the method(s) previously agreed to with the Contractor) before the special inspector leaves the site that day.
   b. A final report of inspections shall be issued within five (5) business days of on-site visits. A report of tests performed shall be issued within five (5) business days of performing tests.
2. Re-inspection and/or re-testing required because of Contractor's non-conformance to the Contract Documents shall be performed by the SITA and shall be paid for by the Contractor. In the event that this occurs, the SITA shall invoice the Contractor directly unless the Owner has indicated it is acceptable to simply bill the Owner and make note that the Owner should be reimbursed for the additional services.

F. The SITA shall provide appropriate quality control staff on-site within five (5) business days of any request by the Contractor to perform inspections and tests required by Specification Section 01 4533, including any re-inspections, retests and/or repeat structural observations.
   1. The Contractor shall be responsible for requesting all site visits necessary for the SITA to perform all quality control services.
   2. If the Contractor does not request inspection, testing, and/or structural observation where required, the work that was not inspected, tested, and/or observed, shall be considered deficient.

G. The SITA shall issue a report to the Architect, Structural Engineer and Contractor if inspection and/or testing indicates that work conforms or does not conform with the contract documents.
   1. If work that is required to be inspected or tested is covered or made permanently inaccessible by the Contractor prior to inspection or testing by the SITA, it shall be assumed that the covered work is non-conforming.

H. The SITA shall comply with the requirements for issuing a Final Report of Special Inspections and Testing required by Section 01 4533.

1.11 QUALITY CONTROL OBSERVATIONS

A. General
   1. The Contractor shall notify every quality control observer (e.g. the CxA and every Design Professional) at least five (5) business days before project conditions are ready for every site visit to make observations that those individuals would like to make.
   2. Quality control observers shall be permitted to issue a written observation report or simply note items verbally in a conversation with any representative of the Contractor onsite. The Architect and/or the Contractor may request written observation reports; however, each Design Professional shall be the sole determinant of if or when written observation reports are issued.

B. Schedule of Site Visits
   1. Before the Quality Control Pre-Construction Meeting, the Contractor shall request from the CxA and every Design Professional a description of project conditions which are associated with every desired site visit. (For example, the Structural Engineer may indicate that after rebar is installed for the first grade beam pour but before concrete is poured, he or she would like to send an Engineer-In-Training or an Observer to the site to make observations.)

C. Scope of Observations
   1. Site visits desired by Design Professionals but not specifically listed as required in Section 01 4533 are not code-required site visits (e.g. Structural Observations from regular visits by the Structural Engineer or his/her representatives are not the Code-Required Structural Observations listed in other portions of Section 01 4533).

2. The observations are visual observations by the Design Professional, or their representative, of the systems which were designed by the Design Professional and are under construction or were recently constructed, for some verification that this work general conforms to the approved construction documents.
3. The determination of which conditions to note during observation shall be made at the sole discretion of the Design Professional or their representative. These observations may be limited to clear indications noted in which the observer believes the Contractor misunderstood the design intent and the misunderstanding is about a significant requirement. The Design Professional shall not be responsible for identifying any and all significant deficiencies.
4. In written observation reports, the Design Professional shall be permitted to identify certain conditions as “registered” (e.g. registered deficiency, registered observation, registered item, etc…) at the Design Professional’s discretion. The Contractor shall fully address all items noted, regardless of whether they are noted as registered or not; however, the Contractor shall provide the Design Professional with evidence that registered items have been fully addressed and ask the Design Professional if that evidence is sufficient, which provides a higher level of quality control.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 QUALITY CONTROL PRE-CONSTRUCTION MEETING

A. The Contractor shall schedule a "Quality Control Pre-Construction Meeting" with the SITA’s Construction Materials Engineer, CxA, Structural Engineer (or a representative of), and the Architect’s Construction Observer. Before scheduling the meeting, the Contractor shall ask the Owner if a representative of the Owner would like to attend. It shall be permitted for people to attend in person or by conference call. During this meeting:
   1. The Contractor shall review the approval status of the qualifications and scope statements from the SITA and CxA with all attendees.
   2. The Contractor shall acknowledge their responsibility to request site visits for all inspections and tests required by Specification Section 01 4533 before work is made inaccessible or covered. The Contractor shall also acknowledge their responsibility to address all deficiencies.
   3. The Contractor, SITA and CxA shall acknowledge their responsibilities to comply with the requirements for Final Reports of Quality Control from firms providing quality control service in Section 01 4533.
   4. The Contractor shall provide the construction schedule to all attendees. If this schedule changes during construction, the Contractor shall notify quality control personnel.
   5. The SITA and CxA shall summarize their understanding of how Specification Sections 01 1400 and 01 4533 shall be applied to this project.
   6. The Contractor shall summarize their understanding of when the Contractor is required to request SITA, CxA and Design Professional site visits for inspections and/or tests.
   7. The Architect’s Construction Observer shall determine if the site visits described for Design Professionals hired by the Architect generally comply with the Owner-Architect Agreement.
   8. The Contractor shall acknowledge their obligation to notify Design Professionals how observations are addressed when observations are noted on reports as “registered”.
   9. The Contractor and SITA and shall determine collaboratively with each other a mutually agreed upon method for SITA technicians to provide the Contractor with written draft reports of any deficiencies before the technician leaves the site on the day the deficiencies are observed. This method shall not require Contractor's staff to be on-site to receive this draft report. As an example, this could include emailing a specified Contractor email address from smart phones or placing a hard copy of reports in a specified Contractor box outside the job trailer.

10. The SITA and CxA shall each determine collaboratively with the Contractor when the last report from each firm (regarding any portion of the project) is likely to be issued.

3.02 QUALITY CONTROL SPECIFIED BY THE DESIGN PROFESSIONALS

A. Within 7 days after the Foundation Pre-Construction Meeting, the Contractor shall notify the SITA of any special inspections and testing required by delegated design professionals. The SITA shall perform all quality control required by each delegated design professional (hired by the Contractor) to be performed by the SITA. The delegated design professionals shall require quality control that they, in their professional opinion, believe appropriate for the SITA to perform given the nature of the work with consideration given to their understanding of the local industry standard of care. Proposers (potential Contractors) shall assume for proposal purposes that each delegated design professional will require the full scope of special inspections and testing (and structural observation if applicable) listed in the material specific sections and tables of Chapter 17 of the IBC unless told otherwise by the delegated design professional before Proposers submit proposals.

B. Where special inspection and testing is specified by other design professionals (e.g. Architect, Structural Engineer, Civil Engineer, MEP Engineer, etc…) to be performed by the SITA for delegated design items, this work shall be performed at a minimum but shall not be a substitute for the quality control program required by the delegated design professional.

3.03 QUALITY CONTROL SPECIFIED BY THE STRUCTURAL ENGINEER

A. Scope: The quality control required by the Structural Engineer shall apply to all work sealed by the Structural Engineer of Record, the individual who sealed the “S” Sheets.

B. Special Inspections for Soils
   1. Reference SITA Scope on the Drawing Sheets: The SITA shall perform special inspection and testing of the soil below the carton void forms and the subgrade in the crawlspace as required by the Civil Engineer on the Civil Drawing sheets for general site grading and fill, with utility trench backfill as required by the Mechanical and Electrical Engineers on the MEP Drawing sheets as well as the Technology Consultant on the Technology Drawing sheets.
   2. Coordination with the Geotechnical Engineer: The SITA shall coordinate inspections and testing of soil with observations by the Geotechnical Engineer, regardless of whether the Geotechnical Engineering Firm is the same firm or a different firm from the SITA firm. The Contractor shall contact the Geotechnical Engineer before the Quality Control Pre-Construction Meeting to determine when the Geotechnical Engineer recommends observations and communicate the schedule on these Geotechnical observations to the SITA. The Contractor shall then notify the Geotechnical Engineer at the appropriate times so that the Geotechnical Engineer can make observations onsite. Where the Geotechnical Engineer recommends that the Geotechnical Engineer be onsite to confirm items (e.g. appropriate depth of a strata, appropriate condition of a strata, anticipated subsurface water conditions, etc…), the SITA shall not perform inspections and testing associated with those items until the Geotechnical Engineer has made such observations.

C. Deep Foundation Elements and Footings

1. The SITA shall observe the installation of all deep foundation elements and/or footings and record all information necessary for the SITA to provide a reliable cost reconciliation by linear foot for each type of deep foundation element and cubic yard of excavation and reinforced concrete for footings. This information shall include the elevation of the grade at the time of drilling, which the SITA may obtain from the Contractor. This information shall also include the elevation of the the bottom of steel casing (or depth below grade at a known elevation), when casing is used. The SITA shall be the sole determinant in the field, for each deep foundation element and for all footings, when sufficient bearing material has been reached and the SITA shall identify for the Contractor, during drilling/excavation, the highest elevations that the SITA considers acceptable so as to assist the Contractor in minimizing work (especially work associated with a unit price adjustment). The SITA shall be the sole determinant in the field, for each deep foundation element, when casing is required and the SITA shall identify for the Contractor, during drilling, the fewest piers the SITA considers necessary to case and the highest elevations that the SITA considers acceptable for the bottom of casing at each pier so as to assist the Contractor in minimizing work (especially work associated with a unit price adjustment).
2. After the Contractor indicates that the last Deep Foundation Element has been installed, the Contractor shall request a Deep Foundation Element Reconciliation Report from the SITA. The SITA shall then provide a tabulation of the difference between assumed and actual conditions for the total cumulative length of uncased deep foundation elements, and cased piers where applicable, for each diameter and reinforcement pattern. The Contractor shall then calculate the change in cost associated with the Pier Reconciliation Report from the SITA and then submit a Request for Information, asking the Architect and any appropriate Design Professionals to review the report and proposed cost change before a Proposed Cost Revision is submitted.

D. Special Inspections and Testing for Concrete Construction
1. Before requesting that SITA personnel visit the site to make inspections of concrete work, the Contractor shall electronically send to the SITA any applicable reinforcement shop drawings and concrete mix design submittals that have been reviewed by the specifying Engineering Firm. The Contractor shall give the SITA sufficient time and lighting at the site, as deemed necessary by the SITA, to perform the specified inspections and testing.
2. The SITA shall provide the following inspections and testing for concrete construction.
   a. Before every concrete pour (generally the same day of the pour unless the SITA deems the scope of the pour to be too large), the SITA shall visit the site and inspect the reinforcement for conformance with the reviewed shop drawings, to the extent that the SITA deems appropriate under the supervision of the Construction Materials Engineer (e.g. yield strength, size, spacing, concrete cover, etc…at a random sampling to be determined by the SITA). While onsite, the SITA shall be empowered but shall not be obligated to make comments and/or ask questions during inspections regarding related conditions, including but not limited to anchor bolt embedment, steel embed plate type and location, formwork, concrete accessories, debris, etc….
   b. During concrete pours, for each intended use (e.g. footing, grade beam, interior slab on grade, etc…), the SITA shall sample concrete from the first concrete truck on each day of concrete pouring and shall determine which other concrete trucks they will sample each day, if any. The SITA shall, however, sample trucks so that no more than 150 cubic yards of concrete is placed at a time without being sampled (e.g. sampling every 150 cubic yards). While onsite, the SITA shall be empowered but shall not be obligated to make comments during inspections regarding related conditions, including but not limited to unsafe conditions, age of concrete in trucks after batching before poured, vibration of concrete, hot weather and cold weather concrete placement methods, temperature and wind speed for the pour that day, and curing conditions for previously poured areas.

c. For each truck that is sampled, the SITA shall do the following and notify the Contractor immediately of any deficiencies so that the Contractor has an opportunity to address those deficiencies:
   1) Collect a copy of the batch ticket and verify that the mix design matches the reviewed submittal for the intended use;
   2) Collect a sample in accordance with ASTM C172.
   3) Perform a slump test in accordance with ASTM C172 and verify that the slump is within the range on the submittal;
   4) Perform an air content test in accordance with ASTM C231or ASTM C173 and verify the air content is within the range on the submittal;
   5) Record the concrete temperature;
   6) Fabricate cylinders molded and standard-cured in accordance with ASTM C31. Each set of cylinders shall consist of either four cylinders that are 6” in diameter and 12” tall or five cylinders that are 4” in diameter and 8’ tall. The Contractor shall be responsible for providing a portion of the site to the SITA for cylinder storage; however, the proper temperature and humidity of curing of all test cylinders and protection of curing on the jobsite shall be the responsibility of the SITA and not the Contractor. The SITA shall also be responsible for transportation from the field to the laboratory. All test cylinders shall be stored in the field 24 hours and then be carefully transported to the laboratory and cured in accordance with ASTM C31.
   7) The Contractor shall have the option to pay the SITA to perform additional inspections and testing, such as additional concrete cylinders whenever desired to determine early strengths. The Contractor shall be responsible for any additional cylinders required to comply with OSHA requirements.

d. For each set of concrete cylinders fabricated, the SITA shall perform compression strength testing in accordance with ASTM C 39 with one (1) cylinder at 7 days and either two (2) 6” diameter cylinders or three (3) 4” diameter cylinders at 28 days. The SITA shall hold one cylinder in reserve and test the reserve cylinder at 56 days only if the average of the 28 day cylinder strengths is below the specified strength and the specifying Engineer indicates it is acceptable to test at 56 days rather than waiting a longer period of time.

E. Special Inspections and Testing for Masonry Construction
   1. Before requesting that SITA personnel visit the site to make inspections of masonry work, the Contractor shall electronically send to the SITA any applicable reinforcement shop drawings and mortar/grout mix design submittals that have been reviewed by the Structural Engineering Firm. The Contractor shall notify the SITA of the rate of masonry construction as it occurs so that the SITA is onsite the first day of structural masonry work and no more than 5,000 square foot of structural masonry is constructed at a time without the SITA being onsite for inspections and testing (e.g. notifying the SITA every 5,000 square feet). The Contractor shall also coordinate the SITA site visits such that structural masonry work is occurring (e.g. masons are installing masonry) when the SITA is performing inspections and tests. Structural masonry for the purposes of quality control is hereby defined as all reinforced concrete masonry walls which are exterior walls and load-bearing walls.
   2. The SITA shall provide the following inspections and testing for masonry construction:
      a. The first day of masonry work, the SITA shall observe the mason mixing the first batches of both mortar and grout, verifying the following (with the mason preparing a batch of mortar or grout for inspection purposes only, to be discarded, if no mortar or grout is needed that day):
         1) the ingredients appear to be consistent with the reviewed mix submittals (e.g. the type of cementitious materials listed on bags appear correct);
         2) the volumetric proportions are consistent with the reviewed mix submittals; and,

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3) containers with known volume are used when batching (allowing the mason to assume that a bag of cement weighing at least 92 pounds is a cubic foot), verifying that shovels are not used when proportioning sand or gravel.

b. At every visit for inspections and testing of masonry construction, the SITA shall do the following:
   1) Inspect bedjoint reinforcement and vertical as well as horizontal conventional reinforcement where work is exposed (i.e. constructed but not obstructed from view with grout or masonry) for conformance with the reviewed shop drawings, to the extent that the SITA deems appropriate under the supervision of the Construction Materials Engineer (e.g. yield strength, size, spacing, masonry cover, etc…at a random sampling to be determined by the SITA);
   2) Inspect grout spaces to verify they are clear of debris;
   3) Sample grout and fabricate a set of three (3) grout prisms (grout only, formed with CMU on all sides, and not a masonry prism which is constructed with two units and a mortar joint) and test in the lab at 28 days in accordance with ASTM C 1019. The Contractor shall be responsible for providing a portion of the site to the SITA for prism storage; however, the proper temperature and humidity of curing of all test prisms and protection of curing on the jobsite shall be the responsibility of the SITA and not the Contractor. The SITA shall also be responsible for transportation from the field to the laboratory.
      (a) every time grout is sampled to make prisms, the SITA shall perform a slump test and verify that the slump is greater than 8”.
   4) While onsite, the SITA shall be empowered but shall not be obligated to make comments and/or ask questions during inspections regarding related conditions, including but not limited to use of integral water repellant in mortar mixes where specified, mortar mixing, grout mixing, grouting where post-installed anchors will be required, anchor bolt embedment of embedded anchor bolts, steel embed plate type and location, masonry accessories, veneer anchors, debris, lift height for grouting, age or segregation of mortar or grout when placed, vibration, hot weather and cold weather practices, material certification for masonry units, proper face-shell bedding, bracing of previously constructed non-loadbearing masonry walls, and curing conditions for previously constructed walls.
   5) Mortar cubes and masonry prisms are not required. If the SITA produces mortar cubes or masonry prisms without the Owner's authorization, the Owner will not pay for mortar cube preparation or mortar cube testing. The Contractor shall be permitted to request and pay for mortar cubes or masonry prisms, if the Contractor desires.

F. Special Inspections and Testing for Steel Construction
   1. Before requesting that SITA personnel visit the site to make inspections of structural steel work, the Contractor shall electronically send to the SITA copies of the welding certifications for every steel welder that will be onsite, manufacturer certification for every adhesive anchor installer that will be onsite and any applicable structural steel submittals that have been reviewed by the Structural Engineering Firm. Upon receipt of the welding certifications, the SITA Staff shall verify these welders have passed qualification tests within the last year using procedures covered in the American Welding Society "Structural Welding Code - Steel," D1.1, latest version. Upon receipt of the adhesive anchor certifications, the SITA Staff shall verify these installers do not have an expired certification. The inspector (acting under the supervision of the Construction Materials Engineer) shall be permitted to accept alternative experience and/or on site demonstration of competency if qualified in the opinion of the inspector.

2. Inspection and Testing at Non-AISC Fabrication Shops: If any steel fabrication occurs off-site at a fabrication shop that is not an AISC certified fabrication shop (excluding Steel Joist Institute facilities manufacturing steel joists), the Steel Fabricator shall pay for the SITA to perform the special inspections or testing required by Section 01 4533 for all such off-site steel fabrication. The Contractor shall notify the SITA when fabrication of steel is scheduled to begin at these facilities. The SITA shall visit these facilities at the beginning of steel work within those facilities and review the quality assurance / quality control documentation at that facility (e.g. processes, welder certifications, logs of welding inspections, etc…). The SITA Staff, acting under the supervision of the Construction Materials Engineer, shall then determine how much (if any) of the specified inspection and testing for on-site steel construction shall apply to the non-AISC-certified shop construction, and then perform that scope of work after communicating to the Contractor when the SITA is to be notified for inspections at the shop. For proposal purposes, Steel Fabricators with non-AISC shops shall assume that the SITA Staff will require the full scope of inspection and testing for on-site steel construction shall apply to the non-AISC-certified shop construction.
3. On-Site Inspection and Testing: The Contractor shall notify the SITA of the status of steel construction as it occurs so that the SITA is onsite after defined areas of the structural steel portion of the project are complete (with the exception that the SITA must be present during the installation of any overhead adhesive anchors), notifying the SITA of any work within those areas that is to be completed at a later date. The Contractor shall not cover up portions of steel construction until the SITA has performed quality control services without identifying any deficiencies at those areas. By the end of the project, the Contractor shall have scheduled visits from the SITA for steel inspection and testing of all structural steel construction (including all miscellaneous steel members but not including cold formed metal framing) that occurred on-site. During each sitevisit, the SITA shall do the following:
    a. Verify off-site fabrication occurred at an AISC certified fabrication shop (by obtaining a copy of the shop's certificate), unless the SITA has provided the specified inspection and testing services at the fabrication shop.
    b. Structural Steel Members: Verify that the structural steel framing member sizes and locations generally conform to the reviewed steel submittals.
    c. Welds that are not Full Penetration welds: Out of all the welds in the area defined by the Contractor as being ready for inspection, the SITA Staff shall determine how many and which welds to visually inspect (acting under the supervision of the Construction Materials Engineer). At a minimum, the SITA shall inspect at least 10% of each type of weld. The SITA shall be permitted to inspect up to 100% of each type of weld if the SITA Staff believe appropriate, based on the conditions observed. The Contractor shall clean all welds identified for visual inspection by the SITA. Visual inspection of welds shall include but not be limited to alignment of members, weld size, length, location, weld/base-metal fusion and signs of cracking.
    d. Welds that are Full Penetration welds:
        1) the Contractor shall clean all full-penetration welds. The SITA Staff shall visually inspect all full-penetration welds.
        2) out of all the full-penetration welds in the area defined by the Contractor as being ready for inspection, the SITA Staff shall determine how many and which welds receive Ultrasonic Testing (acting under the supervision of the Construction Materials Engineer). At a minimum, the SITA shall perform Ultrasonic Testing on at least 10% of each type of full-penetration weld (e.g. normal full-penetration, flare vee, etc…). The SITA shall be permitted to perform Ultrasonic Testing on up to 100% of each type of full-penetration weld if the SITA Staff believe appropriate, based on the conditions observed.
    e. Bolts:

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1) Load-Indicator Type Bolts: Out of all the load-indicator bolts in the area defined by the Contractor as being ready for inspection, the SITA Staff shall determine how many and which load-indicator bolts receive inspection and testing (acting under the supervision of the Construction Materials Engineer). At a minimum, the SITA shall visually inspect at least 10% of each type of load-indicator bolt. The SITA shall be permitted to visually inspect up to 100% of the load-indicator bolts if the SITA Staff believe appropriate, based on the conditions observed. Visual inspection and testing of load-indicator bolts shall include verification that the grade, diameter, location, and minimum length generally conform with the reviewed steel submittals, and that the splines have been snapped off to indicate proper torquing. If any steel to steel connections do not utilize load-indicator type bolts, this section shall apply.
2) Anchor Bolts that are not Overhead Adhesive Anchor Bolts: Out of all the anchor bolts (including base plate anchor bolts, expansion bolts, and adhesive anchor bolts but excluding overhead adhesive anchor bolts) in the area defined by the Contractor as being ready for inspection, the SITA Staff shall determine how many and which anchor bolts receive inspection and testing (acting under the supervision of the Construction Materials Engineer). At a minimum, the SITA shall visually inspect at least 10% of each type of anchor bolts. The SITA shall be permitted to visually inspect up to 100% of the anchor bolts if the SITA Staff believe appropriate, based on the conditions observed. Visual inspection and testing of anchor bolts shall include verification that the bolts are snug tight in the opinion of the SITA, wedge anchors are fully torqued and no longer able to rotate, and verification that the grade, diameter, location, and minimum length beyond the nut generally conform with the reviewed steel submittals.
3) Overhead Adhesive Anchors: The SITA Staff shall be present during the installation of all adhesive anchors oriented vertically such that the anchors are in tension, if there are any such anchors on the project. During the installation, the SITA shall visually inspect the bolts as with all other anchor bolts and inspect the installation, commenting if the installation does not appear to be consistent with the manufacturer's recommended installation procedures.

f. Metal Deck: For all metal deck, verify the type, gauge, finish, weld pattern and sidelap connections conform with the reviewed deck submittals.
g. While onsite, the SITA shall be empowered but shall not be obligated to make comments and/or ask questions during inspections regarding related conditions, including but not limited to unsafe conditions, counterfeit steel members and/or bolts, galvanized steel being cut/scratched/welded (which is not permitted), exterior exposure of non-galvanized material that is not to be painted, welding procedures, steel angle supports around openings in metal deck, deck closures, fire protection, removal of backer plates, grinding of exposed welds, temporary or permanent bracing, and visual acuity of welders.

3.04 QUALITY CONTROL SPECIFIED BY THE CIVIL ENGINEER

A. Reference Civil drawings for quality control required by the Civil Engineer.

3.05 QUALITY CONTROL SPECIFIED BY THE ARCHITECT

A. Special Inspections for Firestopping Penetrations and Joints
1. Before the installation of any firestopping at penetrations and joints, the SITA shall verify that the installer of firestopping at penetrations and joints is an FM4991 "Approved Standard for Firestop Contractors" approved firestop contractor or UL Qualified Firestop Contractor.

2. The SITA shall inspect firestopping at penetrations in accordance with ASTM E 2174 “Standard Practice for On-Site Inspection of Installed Fire Stops” for each type of firestop being used. A unique “type” shall be defined by the UL Fire Resistance Directory utilizing UL’s alpha-alpha-numeric numbering system based on a specific combination of penetrant, substrate and firestop product. For each type of penetration, inspections shall be by either witnessing the entire installation of 10% of the penetrations. Alternatively, for each type of penetration that is not a pre-formed firestopping penetration device, inspections shall be permitted to be by the SITA removing a portion of the firestopping at 2% of the penetrations, verifying the proper depth of installation (and compression at mineral wool, if applicable) and the firestopping installer replacing the firestopping in the presence of the SITA. For preformed-devices, the inspection shall be either by witnessing 10% of the installation of each type of firestop, or alternatively by a post-installation verification that the installed system complies with the reference listed system or engineering judgment. If non-compliant conditions are encountered by the SITA, the SITA shall proceed as directed by ASTM E 2174.
3. The SITA shall inspect firestopping at joints in accordance with ASTM E 2393 “Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers” for each type of firestop being used. A unique “type” shall be defined by the UL Fire Resistance Directory utilizing UL’s alpha-alpha-numeric numbering system based on a specific combination of joint type (head of wall, wall to wall, floor to wall, floor to floor, floor to exterior wall) firestopping material or system (for example, intumescent, caulk, mortar, sealant, mechanical, factory preassembled), and substrates (for example, gypsum wall, concrete floor, composite floor deck). For each type of joint, inspections shall be by either witnessing 5% of the total lineal feet to be installed on the project. Alternatively, inspections shall be permitted to be by the SITA removing at least 1 foot every 500 linear feet of the firestopping on the project, verifying the proper depth (and compression at mineral wool, if applicable) of installation and the firestopping installer replacing the firestopping in the presence of the SITA, or in the case of a pre-formed firestopping joint device, by verifying that the device has been installed in accordance with the reference listed system or engineering judgment. If non-compliant conditions are encountered by the SITA, the SITA shall proceed as directed by ASTM E 2393.
4. If at any time, material removed by the SITA from penetrations and/or joints for a type does not conform to the project requirements, the SITA shall double the amount of destructive testing for that type unless the penetrations and joints were installed by SITA witnessing installation. Further non-compliance shall be addressed as directed by ASTM E 2174 and/or ASTM E 2393. If at any time, installation of firestopping at penetrations and/or joints does not conform with the contract documents while being witnessed by the SITA inspector, the SITA inspector is to proceed as directed by ASTM E 2174 and/or ASTM E 2393. Non-compliance according to these ASTM’s may lead to work stoppage that requires approval by the AHJ to resolve the non-compliance.

3.06 QUALITY CONTROL SPECIFIED BY THE MECHANICAL AND ELECTRICAL ENGINEERS

A. The CxA shall visit the site to make observations as specified by Section 01 9100, Section 01 4533 and Divisions 22-26.

3.07 FINAL QUALITY ASSURANCE REPORTS

A. General
   1. Before applying for a Certificate of Occupancy, the Contractor shall obtain a Final Report from each of the following quality control firms and submit them all at one time to the AHJ:
      a. SITA, Final Report of Special Inspections and Testing
      b. CxA, Final Report of Commissioning
      c. Structural Engineer, Final Report of Structural Engineering Observations
      d. Mechanical Engineer, Final Report of Mechanical Engineering Observations
      e. Electrical Engineer, Final Report of Electrical Engineering Observations

2. Quality assurance personnel shall not be required by the AHJ to issue any certifications, guarantees, or warranties because that is not in their scope of work. Specific language or formatting of the final report shall not be considered a requirement by the AHJ for this project unless the AHJ indicates otherwise before a building permit is issued. (If specific language is desired, quality assurance personnel would need to understand that specific language before performing their scope of work to ensure that they can accurately write a letter with that language.)
3. The Final Report from every firm providing quality control services shall be sealed by a Professional Engineer licensed in the State of Texas and shall indicate, if it is true, that the author of the Final Report:
    a. Represents the firm, identifying which quality control services were provided by that firm,
        1) Has reviewed all previous reports and believes all of the quality control services required by Section 01 4533 to be performed by their firm have been performed,
        2) Has reviewed all previous reports and believes there are no unresolved deficiencies, and,
        3) To the best of his or her knowledge, regarding the portion of the project associated with their scope of work, they believe the construction conforms.
            (a) The SITA shall indicate they believe the results of inspections and testing were within project specifications.
            (b) Quality control observers shall indicate they believe the construction generally conforms with the contract documents.
4. An example of acceptable language in a Final Report is as follows:
    a. For the SITA: “I am the Construction Materials Engineer representing [insert SITA firm’s name], which was responsible for providing Special Inspections and Testing Agency (SITA) services for the [insert project name] located at [insert project address], Huckabee project number [insert project number]. I have reviewed all previous reports from our firm and believe all of the quality control services required by Section 01 4533 of the Project Manual to be performed by the SITA have been performed. I have also reviewed all previous reports from our firm and believe there are no unresolved deficiencies. To the best of my knowledge, regarding the portion of the project associated with our firm’s scope of work, I believe the results of inspections and testing were within project specifications.”
    b. For the CxA: “I am the individual representing [insert CxA firm’s name], which was responsible for providing Commissioning (CxA) services for the [insert project name] located at [insert project address], Huckabee project number [insert project number]. I have reviewed all previous reports from our firm and believe all of the quality control services required by Section 01 4533 of the Project Manual to be performed by the CxA have been performed. I have also reviewed all previous reports from our firm and believe there are no unresolved deficiencies. To the best of my knowledge, regarding the portion of the project associated with our firm’s scope of work, I believe the construction generally conforms with the contract documents.”
    c. For the Structural Engineer, Mechanical Engineer and Electrical Engineer: “I am the [insert project role] representing [insert firm’s name], which was responsible for providing observations for the [insert project name] located at [insert project address], Huckabee project number [insert project number]. I and/or a representative of my firm visited the site at certain stages of construction and made observations. The Contractor is obligated to address all of my observations and has indicated to me that this was done. Therefore, to the best of my knowledge, I believe the construction related to my role generally conforms with the contract documents.”

B. Request for Final Report

1. Within 48 hours of receiving the last inspection, test or observation report expected for the project (regarding any portion of the project) from each firm providing quality control services, the Contractor shall issue an RFI requesting a Final Report of Quality Control from that firm. For clarification, the Contractor shall not be permitted to wait until the end of the project or even until all quality control firms have completed their work. The Contractor shall be responsible for addressing any unresolved deficiencies and submit a written statement to all quality assurance observers in the RFI that their observations were fully addressed before requesting this report from each firm. For proposal purposes, the Contractor shall assume that within ten (10) business days each firm providing quality control services will either issue this report without any unresolved deficiencies or identify in writing any known but unresolved deficiencies. If any unresolved deficiencies are identified during this process, the Contractor shall address these deficiencies and then request a final report again.
2. When the Contractor requests a Final Report of Quality Control from each quality control firm, quality control personnel shall verify that the scope of quality control services required by Specification Section 01 4533 was performed and that any deficiencies identified have been addressed.
   a. If it appears there are no unresolved deficiencies, the firm shall create and distribute a Final Report within ten (10) business days of receiving the request from the Contractor for the final report. The final report shall be sealed by a professional engineer licensed in the state of Texas and shall be distributed to the Contractor and the Architect.
   b. If the firm determines that there are unresolved deficiencies, the firm shall notify the Contractor within ten (10) business days of receiving the request from the Contractor for the Final Report that a Final Report cannot be provided until all unresolved deficiencies are resolved. It is preferred but not required that the firm also provide the Contractor a complete list of all deficiencies identified by the firm to date.

END OF SECTION

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SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Security requirements.

E. Vehicular access and parking.

F. Waste removal facilities and services.

G. Field offices.

1.02 TEMPORARY UTILITIES

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes including review and inspection of work.

B. New permanent facilities may not be used.

1.03 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Use of existing facilities is not permitted.

C. New permanent facilities may not be used during construction operations.

D. Maintain daily in clean and sanitary condition.

E. At end of construction, return facilities to same or better condition as originally found.

1.04 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas.Protect existing facilities and adjacent properties from damage from construction operations and demolition. Implement safety precautions that comply with all regulatory requirements.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.05 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

C. On sites where students are present, no work shall commence prior to fence being in place.

1.06 EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

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1.07 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and plywood sheet materials with closed joints and sealed edges at intersections with existing surfaces:
   1. STC rating of 35 in accordance with ASTM E90.
   2. Maximum flame spread rating of 75 in accordance with ASTM E84.

C. Paint surfaces exposed to view from Owner-occupied areas.

1.08 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.09 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

G. Do not allow vehicle parking on existing pavement.

1.10 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. If materials to be recycled or re-used on the project must be stored on-site, provide suitable and secure non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

C. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling and ventilating equipment, and equipped with sturdy furniture .

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Provide separate work station similarly equipped and furnished, for use of Architect..

D. Locate offices a minimum distance of 50 feet from existing and new structures.

1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to final punch list and review inspection.

B. Remove underground installations to a minimum depth of 3 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

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E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 015719
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Testing indoor air quality before commencement of construction; existing building areas only.

C. Testing indoor air quality after completion of construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
   1. Cleaning of ductwork is not contemplated under this Contract.
   2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
   3. Establish condition of existing ducts and equipment prior to start of alterations.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
   1. Furnish products meeting the specifications.
   2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017.

B. ASHRAE Std 129 - Measuring Air-Change Effectiveness.; 1997 (Reaffirmed 2002).

C. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2010.

D. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.04 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.

B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.

C. Particulates: Dust, dirt, and other airborne solid matter.

D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Indoor Air Quality Management Plan: Describe in detail measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
   1. Submit not less than 60 days before enclosure of building.
   2. Identify potential sources of odor and dust.
   3. Identify construction activities likely to produce odor or dust.
   4. Identify areas of project potentially affected, especially occupied areas.
   5. Evaluate potential problems by severity and describe methods of control.
   6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.

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7. Describe cleaning and dust control procedures.
8. Describe coordination with commissioning procedures.

C. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

D. Duct and Terminal Unit Inspection Report.

E. Indoor Air Quality Testing Plan: Identify:
1. Testing agency qualifications.
2. Locations and scheduling of air sampling.
3. Test procedures, in detail.
4. Test instruments and apparatus.
5. Sampling methods.

F. Indoor Air Quality Testing Reports: Show:
1. Location where each sample was taken, and time.
2. Test values for each air sample.
3. HVAC operating conditions.
4. Certification of test equipment calibration.
5. Other conditions or discrepancies that might have influenced results.
6. Interpretation of test results.
7. Recommendations for improvement of indoor air quality or retesting.

1.06 QUALITY ASSURANCE

A. Firm Qualifications: The indoor air quality testing firm must have a minimum of five years experience specifically in the indoor environmental quality field and must have indoor environmental testing and consulting capabilities. Firm should be a licensed mold assessment company (ACO) through the Texas Department of Licensing and Regulation (TDLR), and should have a minimum of one mold assessment consultant (MAC) on staff. Additionally, the firm's consultants should maintain current certification in indoor environmental consulting (i.e. Certified Indoor Environmental Consultant (CIEC) through the American Council for Accredited Certification (ACAC) or other certifying association. The firm should employ a LEED-Accredited Professional, certified by the United States Green Building Council (USGBC).

B. Laboratory Qualifications: The microbiology testing laboratory utilized by the consulting firm should have a minimum of five years experience, be a licensed mold analysis laboratory through the Texas Department of Licensing and Regulation (TDLR), and should employ a degreed mycologist. The industrial hygiene laboratory utilized by the consulting firm should have a minimum of five years experience, and be accredited by the American Industrial Hygiene Association (AIHA).

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area. Provide pre-construction air filters to all return air registers in adjacent occupied areas.

E. Use of HVAC equipment and ductwork for ventilation during construction is not permitted:
   1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
   2. Exhaust directly to outside.
   3. Seal HVAC air inlets and outlets immediately after duct installation.

F. Do not store construction materials or waste in mechanical or electrical rooms.

G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.
   4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
   5. Clean return plenums of air handling units.
   6. Remove intake filters last, after cleaning is complete.

H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

3.02 INDOOR AIR QUALITY TESTING (IAQ)

A. On-site Observations
   1. A minimum of two (2) visits for renovations and up to six (6) site visits for new construction will be made to the site to conduct on-site observations during the construction phase relative to water intrusion issues or other building conditions that might cause future degradation to indoor air quality. These observations may include but are not limited to landscape grade and drainage, foundation height, exterior wall sealing, roof and wall enclosure penetrations, water or moisture intrusion, plumbing, storage and condition of absorbent building materials, sealing and hygiene of HVAC systems, control of particulates, etc.
   2. This phase may also include a review of specifications for building products such as paint, adhesives, carpet, and cabinetry for products that might degrade future indoor air quality when installed.
   3. A written report will be submitted to the Architect or Owner's representative after each on-site observation. The report will include project conditions on the day of inspection along with cited potential problems areas and photo-documentation as needed.
      a. Critical Condition Report: If a condition is cited that may cause potential microbial contamination in area that is ready to be sealed or covered, a verbal report will be communicated to the Architect or Owner's representative within one business day so the Contractor can have the condition corrected before work is continued.
      b. Standard Report: A written report will be submitted to the Architect or Owner's representative within ten (10) working days of the site visit.

B. Pre-Construction Inspection and Sampling: Perform indoor air quality testing before starting construction, as base line for evaluation of post-construction testing.

1. If the construction project is an addition to an existing facility, pre-construction inspection and sampling will be conducted to determine baseline conditions within the existing facility.
2. The testing conducted in item C-2 of the pre-occupancy testing below will be conducted in areas of the existing facility that will be adjoining the new construction.
3. During construction activities on-site observations will include any impact to the indoor air quality of the existing facility.

C. Pre-Occupancy Inspection and Sampling: Perform indoor air quality testing before occupancy.
1. After substantial completion of the facility and before non-fixed furnishings are delivered, the firm will conduct an IAQ inspection and perform representative sampling for indoor air quality parameters. These measurements will establish background pre-occupancy conditions, and will be evaluated for acceptable levels. All samples collected will be area screening samples to determine the presence of the parameters of interest. If the screening results indicate significant positive results, additional investigation may be required.
2. The air quality sampling includes the collection of samples for the determination of populations and concentrations of total fungal bioaerosols in the ambient air. The sampling also includes the collection of chemical samples for fixed gas analysis for total volatile organic compounds (TVOCs), methane, carbon dioxide, and carbon monoxide. Additional real-time monitoring will be conducted for the following parameters: temperature, relative humidity, carbon dioxide, carbon monoxide, TVOCs, ozone, and large (2.5 to 10 microns) and small particulates (<2.5 microns).
3. Testing in a school facility will include the collection of samples in representative areas of the classroom wings (to include a minimum of 20% of the classrooms), and if part of the new construction, in the cafeteria, library, administration offices, gymnasium, and locker rooms. Additionally, two outdoor samples will be collected on each day of testing for comparison purposes.
4. If significant areas of rubber-backed carpeting and/or composite fixed furnishings are present in the facility, testing will also be conducted in representative areas for 4-phenylcyclohexene and formaldehyde in the ambient air. This testing will not be conducted if carpeting and fixed furnishings have been installed which are certified to be free of these chemicals.
5. Testing for radon should be conducted only for subterranean structures or in geographical areas where radon has been previously documented on a reoccurring basis.
6. Testing for lead-based paint and asbestos-containing materials will not be conducted unless there is an indication that lead-based paint and/or asbestos-containing materials may be present in the existing structure, and that it may be impacted by the new construction activities. Historical asbestos testing records, asbestos management plans, or lead-based paint surveys may be provided in lieu of testing.
7. A report of findings and any recommendations will be provided within fifteen (15) working days of the sampling event.

D. Do not start pre-occupancy indoor air quality testing until:
1. All construction is complete, including interior finishes.
2. HVAC systems have been tested, adjusted, and balanced for proper operation.
3. Cleaning of inside of HVAC ductwork, if specified elsewhere, has been completed.
4. New HVAC filtration media have been installed.

E. Post-Occupancy Inspection and Sampling:
1. At five (5) months and eleven (11) months following substantial completion, but prior to the one (1) year project inspection, the testing conducted in item C-2 of the pre-occupancy testing above will be repeated.
2. A report of findings and any recommendations will be provided within fifteen (15) working days of the sampling event.

F. Indoor Air Quality Acceptance Criteria
   1. Upon completion of the project, the indoor air quality testing firm will provide a report of findings to the Architect or Owner's representative indicating any IAQ parameters that do not meet the acceptance criteria.
   2. The following criteria will be used to determine acceptance:
      a. Fungal Bioaerosols - measure in relation to outdoor air, generally not higher than outdoor air, and containing indoor populations and concentrations of fungi that are considered normal and typical. Use professional judgment of testing firm.
      b. Carbon Monoxide - measure in ppm, in relation to outdoor air. Not more than 2 ppm over outdoor air levels, and less than 9 ppm.
      c. Carbon Dioxide - measure in ppm, in relation to outdoor air. Not more than 700 ppm higher than outdoor air.
      d. Methane - measure in ppm. Not more than 5 ppm.
      e. Total Volatile Organic Compounds (TVOCs) - measure in ppm as methane, or micrograms per cubic meter (µg/m3) - not more than outdoor air, and less than 5 ppm (calculated as methane) or 3,000 µg/m3.
      f. Total Particulates - measure in total particle counts per cubic foot - total particle counts generally less than one-half (1/2) of outdoor air. Particle counts broken down to small (<2.5 microns) and large (2.5 to 10 microns).
      g. Radon - less than 2 picoCuries per liter (pCi/L).
      h. Ozone - nor more than outdoor air, and less than 0.1 ppm.
      i. Formaldehyde - measure in parts per million (ppm) - less than 0.050 ppm.
      j. 4-Phenylcyclohexene(if rubber-backed products) - measure in micrograms per cubic meter (µg/m3) - not more than 6.5 µg/m3.
      k. Lead - have paint supplier or contractor provide documentation of lead-free paint.

G. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner.

END OF SECTION

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SECTION 015723
TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Storm Water Pollution Prevention and Pollution Control Plan as required by the Texas Commission on Environmental Quality (TCEQ), effective March 2023.

B. Related Sections:

Section 31 0000 - Earthwork

1.02 QUALITY ASSURANCE

A. State Standards: Execution of the Pollution Prevention and the Pollution Control Plan shall meet all requirements set forth by TCEQ under the Texas Pollution Discharge Elimination System (TPDES) regulations.

PART 2 - PRODUCTS

NOT APPLICABLE.

PART 3 - EXECUTION

3.01 PERFORMANCE

A. General: Implement all the requirements detailed in the Erosion Control Plan and any additional pollution prevention and control measures required by the TCEQ.

B. The Erosion Control Plan is included as part of the construction plans. The erosion control measures shown on the plans are the minimum required for this project. The contractor shall implement additional erosion control devices as construction sequence and activities dictate.

C. The SWPPP document (including N.O.I. and N.O.T.) that makes up the balance of the SWPPP shall be prepared by the contractor at his expense. The contractor shall be the Owner/Operator of the SWPPP and responsible for executing and filing the N.O.I. and N.O.T. and paying all fees required by TCEQ.

END OF SECTION

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SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements: Product quality monitoring.

1.03 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content; Current Edition.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Shop drawings, product data, and samples under provisions of Section 01 3000.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

D. Specific Products to be Reused: The reuse of certain materials and equipment already existing on the project site is not prohibited.

1. If reuse of other existing materials or equipment is desired, submit substitution request.
2. 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.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Where other criteria are met, Contractor shall give preference to products that:

1. Are extracted, harvested, and/or manufactured closer to the location of the project.

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2. Have longer documented life span under normal use.
3. Are made of recycled materials.
4. If made of wood, are made of sustainably harvested wood, wood chips, or wood fiber.

C. Provide interchangeable components of the same manufacture for components being replaced unless noted otherwise in the contract documents.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. All substitutions shall be submitted on the Architects form as described in paragraph 3.03.

B. Product Substitution - Prior to Bid
1. No products shall be used on the project unless they are specified or have received prior approval.
2. Products to be reviewed prior to bid shall be submitted and reviewed under the provisions of this section.
3. Substitution request including all required documentation must be delivered to the Architect's office no later than ten (10) calendar days prior to the proposal date designated in the project manual. Requests submitted late will not be considered.
4. No product will be considered "as equal" to the product specified until it has been included as an allowable substitution, in a written Addendum to the project.

C. Product Substitution - Post Contract Award
1. Product substitutions are not allowed except for the following provisions:
   a. Product is required for compliance with interpretation with code compliance.
   b. Product specified is unavailable.
   c. Product proposed will provide a credit to the Owner.
      1) Contractor shall provide amount of proposed savings on the substitution request form.
   d. Product proposed will provide a substantial benefit to the Owner's schedule.
      1) Contractor shall clearly delineate the positive impact to the project schedule.
   e. Product supplier contractor default.
      1) Written documentation will be required to substantiate request.
2. Substitution request including all required documentation must be delivered to the Architect's office no later than fifteen (15) calendar days after execution of the Contract.
3. Reimbursement of Architect's costs
   a. In the event substitutions are proposed to the Architect after the Contract has been awarded, the Architect will record all time used by him and by his consultants in evaluation of each such proposed substitution.
   b. Whether or not the Architect approves a proposed substitution, the Contractor promptly upon receipt of the Architect's billing shall reimburse the Architect at the rate of two and one-half times the direct cost to the Architect and his consultants for all time spent by them in evaluating the proposed substitution.

3.02 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Proposed product substitution shall comply with all applicable codes. Products not conforming to codes shall be removed and replaced at Contractors expense.

B. Coordination of substitutions:
   1. Prior to each product substitution, carefully review and coordinate all aspects of each item being submitted.
   2. Verify that each item and the submittal for it conform in all respects with the specified requirements.
   3. By submitting the substitution request form with each submittal, the contractor certifies that this coordination has been performed.

C. Substitutions:
   1. The Contract is based on the standards of quality established in the Contract Documents.
   2. Products specified by reference to standard specifications such as ASTM and similar standards do not require further approval.
   3. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved in writing for this Work by the Architect.

D. Coordination of Materials and Installation
   1. General contractor shall install all fire protection, electrical and data wiring in conduit as high as possible and above mechanical ductwork. General contractor shall install all fire protection, electrical, data, and wiring in conduit in areas designated on the plans while coordinating structure, mechanical equipment/ductwork, lighting, building controls, and architectural systems. The proposed layout of these systems and conduit shall be reviewed with and accepted by the architect prior to installation. Systems and conduit shall group in the area designated by the construction documents in an orderly and clean installation. Final locations and conditions of these systems and conduit shall only be accepted by the architect upon review after installation.

E. Miscellaneous Materials
   1. If proposed product substitution requires additional materials or accessories for installation in the project, Contractor shall be responsible for all costs.

F. Finishes
   1. Proposed product substitution shall not decrease the selection of colors or finishes.

G. Storage and Handling
   1. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

H. Warranty
   1. Warranty of product shall not be less than that of specified product.

3.03 PRODUCT SUBSTITUTION REQUEST FORM

A. The Architect’s “Substitution Request Form” must be used for each product submitted for consideration. The form is attached following this Section.

B. The Individual or Firm requesting a substitution must document that the requested substitution is equal or superior to the specified product. Failure to provide clear, accurate, and adequate documentation will be grounds for rejection. Any re-submittal will be handled as a new request.

C. Required documentation shall consist of applicable information which would aid the Architect in making an informed decision. Include side by side product comparisons, technical data, laboratory test results, product drawings, etc. References shall include three projects, which are from one to two years old, and three projects older than five years. Provide a list of references with the owners contact name and phone number.

D. If use of the proposed product would result in changes to the design of the building, the submittal shall describe fully the changes required to the drawings or project manual. Any cost differences resulting from modifications to the drawings and project manual and the cost of making the changes shall be borne by the Product Supplier.

E. Incomplete forms shall be rejected. The decision of the Architect is final.

3.04 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.
   5. Coordinate dimensions of Owner furnished materials and equipment with drawings and specifications prior to installation to ensure proper fit in conjunction with other Contractor supplied materials and equipment.

3.05 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged in manufacturer's original container with labels intact and legible.
   1. Maintain packaged materials with seals unbroken and labels intact until time of use.
   2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

G. The Architect may reject as non-complying such material and products that do not bear identification and satisfactory to the Architect as to manufacturer, grade, quality, and other pertinent information.

H. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

I. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.06 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

C. Store and protect products in accordance with manufacturers' instructions. Failure to comply will result in rejection of products for use on job.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

J. Comply with manufacturer's warranty conditions, if any.

K. Do not store products directly on the ground.

L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

N. Prevent contact with material that may cause corrosion, discoloration, or staining.

O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

P. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

Q. In event of damage, promptly make replacements and repairs to the approval of the Architect and at no additional cost to the Owner.

R. Additional time required to secure replacements and to make repairs will not be considered by the Architect to justify an extension in the Contract Time of Completion.

END OF SECTION

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MORE THAN ARCHITECTS

INSTRUCTIONS FOR USE OF SUBSTITUTION REQUEST FORM

STEPS

1. Substitution request **including all required documentation** must be emailed to the Project Leader at the Architects office no later than the date indicated in the specifications. Requests submitted late will not be considered. Contact information can be found on the Huckabee website bidding section under the specific project at: www.huckabee-inc.com/construction/

2. The Huckabee "Substitution Request Form" must be used for each project submitted for consideration.

3. The Individual or Firm requesting a substitution must document that the requested substitution is equal or superior to the specified product. Failure to provide clear, accurate, and adequate documentation will be grounds for rejection. Any re-submittal will be handled as a new request.

4. Required documentation shall consist of applicable information which would aid the Architect in making an informed decision. Include **side-by-side product comparisons**, technical data, laboratory test results, product drawings, etc. References shall include three projects which are from one to two years old, and three projects older than five years. Provide a list of references with the owner's contact name and telephone number.

5. If use of the proposed product would result in changes to the design of the building, the submittal shall describe fully the changes required to the drawings or specifications. Any cost differences resulting from modifications to the drawings and specifications and the cost of making the changes shall be borne by the Product Supplier.

6. **No** product will be considered "as equal" to the product specified until it has been included as an allowable substitution in a written Addendum to the project.

7. The decision of the Architect is final.

MORE THAN ARCHITECTS

SUBSTITUTION REQUEST FORM

Architect Project No:_____ Bid Date:_____ Date of Request:_____

Project Name: _____

SUBSTITUTION REQUEST BY:

Firm:_____

Address:_____

_____

Phone: _____

Fax: _____

We hereby request that the following Substitution be allowed in lieu of the Product specified on the above project.

ARCHITECT / ENGINEERS RESPONSE:

☐ APPROVED ☐ APPROVED AS NOTED

☐ NOT APPROVED ☐ SUBMITTED TOO LATE

☐ FAILED TO PROVIDE ADEQUATE INFORMATION

REMARKS:_____

_____

BY:_____DATE:_____

SPECIFIED PRODUCT_____ **SPECIFICATION SECTION** _____

PROPOSED PRODUCT SUBSTITUTION_____

This request includes the following: attached Technical Data, Laboratory Tests and proposed changes to the Drawings and Specifications, which the proposed Substitution will require for proper installation.

_____

_____

The Firm requesting the Substitution agrees to pay for changes to the building design, including Architectural, Engineering, and detailing costs caused by the requested Substitution. ☐ YES ☐ NO ☐ NOT APPLICABLE

What effect does the Substitution have on other trades? _____

_____

What effect does Substitution have on Construction Schedule? _____

_____

Differences between proposed Substitution and specified item? _____

_____

Manufacturer's guarantees of the proposed and specified items are: _____ Same _____ Different
(If different, explain on attachment)

The undersigned state that the function, appearance and quality are equivalent or superior to the specified item.

_____
SIGNATURE

_____ _____
TITLE DATE

Huckabee

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SECTION 016210
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.

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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 017000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

K. Administration of Warranty Phase.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 013000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 014000 - Quality Requirements: Testing and inspection procedures.

D. Section 015000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

F. Individual Product Specification Sections:
   1. Advance notification to other sections of openings required in work of those sections.
   2. Limitations on cutting structural and load bearing members.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.

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4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.
6. Include in request:
    a. Identification of Project.
    b. Location and description of affected work.
    c. Necessity for cutting or alteration.
    d. Description of proposed work and products to be used.
    e. Effect on work of Owner
    f. Date and time work will be executed.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
    1. Minimum of 5 years of documented experience.

B. For surveying work, employ a land surveyor registered in Texas and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in Texas. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in Texas.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
    1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
    2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
    1. Minimize amount of bare soil exposed at one time.
    2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
    3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
    4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
    1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
    2. Indoors: Limit conduct of especially noisy interior work to 8 am to 5 pm.

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H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
   1. Pest Control Service: Monthly treatments.

I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that 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. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

G. Prior to start of work, photo and/or video document all portions of the building.

3.02 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 any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, Contractor will convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section. Contractor, subcontractor, and manufacturer's representative shall be present.

C. Notify Architect seven (7) days in advance of meeting date.

D. Prepare agenda and preside at meeting:
1. Review approved submittals.
2. Review conditions of examination, preparation and installation procedures.
3. Review coordination with related work.
4. Installation schedule.

E. Record minutes and distribute copies within two days after meeting to participants, with one copies to Architect, Owner, participants, and those affected by decisions made.

F. Pre-installation meeting shall not be scheduled until approved submittals are verified by the Contractor.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that indicated on drawings.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

H. Utilize recognized engineering survey practices.

I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.

J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.

B. Contractor shall ensure all bid and proposal documents and contracts include, if applicable to their trade, all required information related to trench excavation and working safety in compliance with Texas Health and Safety Code 756.021.

C. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

D. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

E. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

F. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

G. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 NOTIFICATION OF ARCHITECT

A. The Contractor shall notify the Architect a minimum of 48 hours prior to the covering up of any work in progress, in order for the architect to make proper field observations of the work in place. The Contractor shall place NO concrete, fill-in ditches, or cover up walls or ceilings without first contacting the Architect, as noted above and receiving approval.

3.07 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.
   2. Provide sound retardant partitions of construction indicated on drawings 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.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

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E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunication, and Technology): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. 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.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment including those above acoustical lay-in ceilings and gypsum board/hard ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

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.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
   1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
   2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
   3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.08 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight at interior and weathertight at exterior to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.09 PROGRESS CLEANING

A. General:
   1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
   2. Do not allow accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
   3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.
   4. Provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology.

B. Site:
   1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
   2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service arrangements to meet the requirements of subparagraph A.1 above.
   3. Maintain the site in a neat and orderly condition at all times.

C. Structures:

1. Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
2. Weekly, and more often if necessary, sweep interior spaces clean.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a hand-held broom.
3. As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials are installed. Damaged floors will be removed and replaced.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.

3.10 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.11 SYSTEM STARTUP

A. Coordinate with General Commissioning Requirements per Mechanical Specifications.

B. Coordinate schedule for start-up of various equipment and systems.

C. Notify Architectand Owner 14 days prior to start-up of each item.

D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

F. Verify that wiring and support components for equipment are complete and tested.

G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

I. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.12 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

B. Refer to individual specification sections for more specific demonstration and training requirements.

3.13 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Division 23 for specific requirements.

3.14 FINAL CLEANING

A. "Clean", for the purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

B. The Contractor shall have initial cleaning complete prior to the Architect performing the “Punch List” walkthrough. The building shall be thoroughly (ready for occupancy) cleaned prior to the Owner acceptance (Substantial Completion) of the building.

C. Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in the Article above.

D. Communication Spaces (MDF, IDF Rooms):
   1. Preparing Communication Spaces (MDF, IDF) Rooms For Owner Acceptance.
      a. Contractor shall ensure that all communication spaces supporting owner network electronics are properly prepared for equipment installation.
      b. All steps must be completed seven days prior to the date of equipment installation.
         1) All room electrical systems, receptacles, power and room cooling shall be completed and verified by the Owner or Owner’s representative.
         2) All room lighting shall be completed.
         3) All entry doors shall be installed and locked with keys delivered to the Owner. Access control doors may not be in operation at this time and the room must be secured. Makeshift doors must have prior approval from the Owner or Owner’s representative before installation can begin.
         4) All plywood backboards shall be installed and painted.
         5) All copper and fiber cabling shall be tested, labeled and all test reports and record drawings reviewed and approved by the Owner or Owner’s representative.
         6) All copper and fiber patch cordage shall be installed or at a minimum, delivered to the Owner for installation.
         7) All equipment racks, ladder racks and other required pathway supports shall be properly bonded and grounded to the telecommunications grounding busbar located in the room. All grounding backbones shall be installed from the busbar to the approved building ground and the system tested and approved by the Owner or Owner’s representative.
         8) All sleeves and wall penetrations must be properly fire stopped.
         9) If equipped, all room ceilings shall be installed.
   2. Final Cleaning of Communication Spaces (MDF, IDF) Rooms.
      a. All MDF and IDF rooms shall be cleaned prior to the installation of Owner network electronics. This is to prevent construction dust and debris from damaging the equipment.
      b. Contractor shall coordinate the date of installation with the Owner so that the cleaning of all MDF and IDF spaces shall be performed no greater than two calendar day prior to the deployment of the equipment.

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c. Contractors shall remove all large pieces of drywall, ceiling tiles and other construction related waste from the room. All contractor boxes and other containers must be removed unless prior approval has been given by the Owner.
d. Residual plaster dust shall be brushed, broomed and vacuumed from all equipment racks, ladder racks, conduit sleeves and other wall mounted devices and enclosure surfaces.
e. All floors shall be swept then vacuumed. Do not use wet or damp clothes or mops for this purpose.
f. Contractor shall then wipe down all items as explained above with a damp cloth, let dry, then wipe down a second time using a dry cloth to remove any residual streaks or smears that appear.
g. Mop all floors, let dry, then mop with a second application. Do not use any cleaning agents that are not approved for the floor type used in the room.
h. Notify the Owner and Owner's representative for final acceptance. Contractor shall retain staff resources to address items discovered by the Owner or Owner's representative and re-clean the room as needed.

E. Site:
1. Unless otherwise specifically directed by the Architect, broom clean paved areas on the site and public paved areas adjacent to the site. Powerwash paved surfaces, as required, to remove any stains caused by construction materials, vehicles, or workers, as approved by the Architect, and at no additional cost to the Owner.
2. Completely remove resultant debris.

F. Structures:
1. Exterior:
a. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
b. Remove all traces of splashed materials from adjacent surfaces.
c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
d. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the Owner.
2. Interior:
a. Visually inspect all interior surfaces (floors, walls, ceilings, fixtures, furniture, appliances, and equipment) and remove all traces of soil, waste materials, smudges, and other foreign matter.
b. Remove all traces of splashed material from adjacent surfaces.
c. Remove paint droppings, spots, stains, and dirt from finished surfaces.
3. Glass: Clean inside and outside.
4. Polished surfaces: To surfaces requiring routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished.

G. Schedule final cleaning as approved by the Architect to enable the Owner to accept a completely clean Work.

3.15 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Architect in accordance with the General Conditions of the Contract.

3.16 CLOSEOUT PROCEDURES

A. Project Closeout
1. No later than 60 days prior to Project Completion, as scheduled on the Contractors Critical Path Schedule, the Contractor shall:

a. Develop a Project Completion List for any and all tasks that remain along with a schedule for the completion of each. This list and schedule shall be written and delivered to the Owner and Architect.
b. Provide “hands-on” training to the Owner of all major systems as identified in Section 01 7800 – Closeout Submittals

B. Substantial Completion
1. Prior to requesting inspection by the Architect, use adequate means to assure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.
2. No later than 30 days prior to the scheduled Substantial Completion date the Contractor shall call for a project walk through to determine if the project is substantially complete.
a. The Contractor shall prepare and submit a list of deficiency items as required by Paragraph 9.8.2 of the General Conditions. This list shall be submitted to the Architect a minimum of 7 days prior to the scheduled walk through.
b. The Contractor shall provide copies of the complete TAB (Commissioning) report and verification that all repairs have been made and that the systems are operational. This report and verification shall be submitted to the Architect a minimum of 7 days prior to the scheduled walk through.
c. The Contractor shall obtain the Certificate of Occupancy from the AHJ and supply a copy to the Architect a minimum of 7 days prior to the scheduled walk through and before substantial completion will be issued.
d. On the scheduled date of the walk through and after receipt of the deficiency list (punch list) the Architect will inspect the project to determine the status of completion.
e. Following inspection of the work, the Architect determines that the work is not substantially complete:
1) The Architect promptly will so notify the Contractor, in writing, giving the reasons therefore.
2) The Contractor shall remedy the deficiencies and notify the Architect when ready for re-inspection. The Architect will make only one trip to re-inspect the project.
3) The Architect shall be entitled to reimbursement of costs on an hourly basis for time spent to re-inspect the project. Rate for reimbursement shall be two hundred dollars per hour ($200.00/hr) including travel time and shall be charged against the Contractors retainage held for this work.
3. When the Architect concurs that the Work is substantially complete:
a. The Architect will prepare a "Certificate of Substantial Completion" on AIA Form G704, accompanied by the Contractor's list of items to be completed or corrected, as verified by the Architect.
b. The Architect will submit the Certificate to the Owner and to the Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.

C. Final Completion
1. Prepare and submit the notice required by the first sentence of Paragraph 9.10.1 of the General Conditions.
2. Verify that the Work is complete including, but not necessarily limited to, the items mentioned in Paragraph 9.8.2 of the General Conditions.
3. Certify that:
a. Contract Documents have been reviewed;
b. Work has been inspected for compliance with the Contract Documents;
c. Work has been completed in accordance with the Contract Documents;
d. Equipment and systems have been tested as required, and are operational;
e. Work is completed and ready for final inspection.
4. The Architect will make an inspection to verify status of completion.

5. Should the Architect determine that the Work is incomplete or defective:
   a. The Architect promptly will so notify the Contractor, in writing, listing the incomplete or defective work.
   b. Remedy the deficiencies promptly, and notify the Architect when ready for re-inspection.
6. When the Architect determines that the Work is acceptable under the Contract Documents, he will request the Contractor to make closeout submittals.

D. Closeout Submittals
1. Closeout submittals as described in Section 01 7800 and Architect approval secured.
2. Refer attached Check List.
3. Contractor shall deliver all attic stock referenced in specifications. Attic stock shall be delivered to owners designated location. Contractor shall obtain a signed receipt of delivery.
4. Contractor shall obtain Certificate of Occupancy from the AHJ and submit a copy to the Architect.

E. Release of Funds
1. Retainage for the project will be held until project closeout is complete as verified by the items in paragraph above and the attached Check List including the completion of all Punch List items.
2. The Architect will estimate the cost of each item on the Punch List, withholding funds for each which shall be separate from the retainage. These funds will be released to the Contractor as items are completed and verified on the Punch List.
3. THE RETAINAGE WILL NOT BE RELEASED UNTIL CERTIFICATE OF OCCUPANCY FROM THE AHJ HAS BEEN SUBMITTED TO THE ARCHITECT.
4. THE RETAINAGE WILL NOT BE RELEASED UNTIL THE PROJECT CLOSEOUT IS COMPLETE.

F. Final adjustment of accounts
1. Submit a final statement of accounting to the Architect, showing all adjustments to the Contract Sum.
2. If so required, the Architect will prepare a final Change Order showing adjustments to the Contract Sum which were not made previously by Change Orders.

FINAL ACCEPTANCE CHECKLIST

DATE:_____

PROJECT NAME:_____

OWNER'S NAME:_____

COMPLETED BY:_____

TO:_____

COPY TO:_____

THE FOLLOWING CHECKLIST IS COMPLETED AND THEREFORE THE PROJECT IS READY FOR FINAL PAYMENT AS OUTLINED IN THE CONTRACT DOCUMENTS.

Received Final Payment Request and Release of Claims.			
Final Change Order Completed and Signed By All.			
Contractor's Affidavit of Payment of Debts and Claims.			
Consent of Surety To Final Payment.			
All Operation & Maintenance Manuals Received.			
Final Record Drawings Received.			
All Guarantees and Warranties Received.			
Punchlist Fully Cleared (Attached Copy).			
Air Quality and Commissioning Completed and All Items Addressed and Corrected.			
Written Acknowledgement of Lead and Asbestos Free.			
All Attic Stock Delivered to Owner.			
Certificate of Occupancy Obtained From AHJ			

EXPLANATION OF ANY OUTSTANDING ISSUES OR DEFICIENCIES:_____

_____

_____

HEREBY SUBMITTED FOR REVIEW:

SIGNED:_____ **DATE:**_____

3.17 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
   1. Review warranty request procedures with the Architect and Owner no less than two weeks prior to Date of Substantial Completion.
   2. All work performed and completed during the Contractor's one year warranty period shall be noted as complete and signed off on accordingly on a warranty request form as agreed upon by Owner and Architect. The form will be provided to the Contractor for each item requested for maintenance or repair and is required to be returned, once the work is complete, in the same originally sent document format with cause and corrective action described in detail. All work during the Contractor's one year warranty period shall be communicated by the Contractor to both the Owner and Architect.
   3. Contractor shall maintain a complete and accurate schedule of the dates of Substantial Completion, dates upon which the one year warranty on each phase or building which is substantially complete will expire, and dates of Final Completion. Contractor agrees to provide notice of the warranty expiration date to Owner and Architect at least one month prior to the expiration of the one year warranty period on each building or each phase of the building, which has been substantially completed. Prior to termination of the one year warranty period, Contractor shall accompany the Owner and Architect on review of the building and be responsible for correcting any reasonable deficiencies not caused by the Owner or by the use of the building which are observed or reported during the review. For extended warranties required by various sections, i.e. roofing, compressors, mechanical equipment, Owner will notify the Contractor of deficiencies and Contractor shall start remedying these defects within three (3) days of initial notification from Owner. Contractor shall prosecute the work without interruption until accepted by the Owner and the Architect, even though such prosecution should extend beyond the limit of the warranty period.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for digital project records.

B. Project Record Documents.

C. Operation and Maintenance Data.

D. Closeout Documents.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Section 01 7900 - Demonstration and Training: Training requirements.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

F. Individual Product Sections: Specific requirements for demonstration and training.

1.03 SUBMITTALS

A. Submittal Procedure

1. Within sixty (60) days following the Notice to Proceed, the Contractor shall submit a list of Expected Closeout Documents for review by the Architect. This list shall include project record documents, operation and maintenance data, warranties, bonds, contract forms, health/safe environment data, attic stock sign offs, Owner training, certifications and inspections, and other types as indicated. All items on the list shall be titled with spec section number and general description - Example: "09 3000 Tiling - 1 year warranty".
2. The Architect will review the list of Expected Closeout Documents, provide revision comments and return it to the Contractor within fourteen (14) business days. If revisions are required, the Contractor shall then resubmit a revised list to the Architect and Owner within fourteen (14) business days and thereafter until approved.
3. Contractor may submit Closeout Documents by Specification Division in full as scopes of work are completed.
4. Within sixty (60) calendar days of substantial completion, Contractor shall submit closeout submittals as required in accordance with this section and secure Architect’s approval.
5. Contractor shall provide cover page with space for Contractor and Architect review stamps for each submission.
6. The Architect's approval of the current status of Project Record Documents may be a prerequisite to the Architect's approval of requests for progress payment and request for final payment under the Contract.
7. Prior to submitting each request for progress payment, secure the Architect's approval of the current status of the Project Record Documents.
8. Prior to submitting request for final payment, Contractor shall submit the final Project Record Documents to the Architect and secure approval.
9. Contractor shall submit a complete set of closeout documents for each project where multiple projects are combined under a single proposal package.
10. Review and Final Submission of Closeout Submittals
    a. Participate in review meetings as required.
    b. Documents shall be reviewed and verified by contractor prior to submission to the Architect.

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c. Review submittal with Owner and Architect prior to final submittal for review and electronic archiving.
d. Number shall be Architects project number followed by the appropriate specification section - consecutive submittal number for section.
(Example - 1234-01-01 Tiling 09 3000 - 5)
When material is re-submitted for any reason, transmit under a new letter of transmittal and with a new transmittal number. On re-submittals, cite the original submittal number for reference.
e. Contractor shall allow 14 days from date of submission for Preliminary Architectural Review excluding delivery time to and from the Contractor.
f. The contractor shall be responsible for delays caused by rejection of inadequate or incorrect submittals.
g. Submittals received by Architect without General Contractor's stamp will be rejected.
h. Make changes required from the Preliminary Architectural Review and deliver the Final Project Record Documents to and secure approval from the Architect. When revised for resubmission, identify all changes made since previous submission.
i. Contractor will pay all associated cost in preparing close-out documents.

11. Closeout Submittals Requirements.
a. Closeout and Record Documents as required by this section shall be provided to the Owner upon completion of the project. Submit the number as outlined below:
1) Project Record Documents - Drawings and Project Manual
(a) One (1) copy on USB Flash Drive
2) Closeout Documents – Including Operation and Maintenance Manuals
(a) One (1) copy on USB Flash Drive
b. Electronic Submittal Format.
1) The digital file shall be set up using a non-proprietary “PDF” format.
2) All data shall be indexed/book marked and hyperlinked to associated data.
3) Data shall be searchable by key word. All data shall allow printing of material.
4) Electronic submittal shall follow the format shown in Part 3.
5) Under paragraph 3.05 Assembly of Operations and Maintenance Manuals, all items shall be organized as specified.
c. Training Session Submittal Format.
1) Refer to Section 01 7900 - Demonstration and Training.

B. Project Record Documents: Submit documents to and secure approval from Architect prior to request for final Application for Payment.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. All record documents shall be maintained on site in digital format; record actual revisions to the Work, including but no limited to:
1. Drawings.
2. Specifications.
3. Addenda.
4. RFIs.
5. Change Orders and other modifications to the Contract.
6. Reviewed shop drawings, product data, and samples.
7. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Contractor shall maintain and protect the record documents with backups and/or any other means necessary to ensure the integrity of the digital files.

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D. In the event of loss of recorded data, use means necessary to again secure the data to the Architect's approval.
   1. Such means shall include, if necessary in the opinion of the Architect, removal and replacement of concealing materials.
   2. In such case, provide replacements to the standards originally required by the Contract Documents.

E. Record information concurrent with construction progress. Record Documents shall be current and submitted with each pay application.

F. Specifications: Record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

G. Record Drawings and Shop Drawings: Mark each item to record actual construction including:
   1. On the cover sheet of the Project Manual and the Drawings, provide the following statement, “RECORD DOCUMENTS- The changes noted herein are indicated in color and are designated by a revision delta (RD). The changes are recorded by [Contractor Name], [Date].”
   2. Prior to construction, insert all addenda to the record documents, both drawings and specifications as modified.
   3. Making entries on Drawings.
      a. Using colored markings, clearly describe the change by graphic line and note as required.
      b. Date all entries.
      c. Call attention to the entry by a "cloud" drawn around the area or areas affected. Add delta triangle with the letters “RD” inside the triangle.
      d. In the event of overlapping changes, use different colors for the overlapping changes.
   4. In addition to field changes, mark the record documents with areas modified by RFIs and change orders and hyperlink to the corresponding data.
   5. Schematic layouts.
      a. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, are shown schematically and is not intended to portray precise physical layout.
      b. Clearly identify the item by accurate note such as "cast iron drain," "copper water", and the like.
         1) Show, by symbol or note, the vertical location of the item ("under slab", "in ceiling plenum," "exposed," and the like).
         2) Make all identification sufficiently descriptive that it may be related reliably to the Specifications.
   6. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   7. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   8. Field changes of dimension and detail.
   9. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. Refer to Divisions 21, 22, 23, 26, 27 and 28 for system requirements.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into organized file folders for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate folder for each system.

C. Cover: Identify each USB Flash Drive with the title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

D. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants,Contractor and subcontractors, with names of responsible parties organized by division with project scopes listed for each company.

E. Tables of Contents: List every item using the same identification as on the content section and hyperlinked accordingly; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

F. Contents: Prepare final project record closeout documents for delivery to Owner in PDF file format as follows:
   1. FILE FOLDER: XXXX-XX OWNER'S NAME - PROJECT NAME - CLOSEOUT SUBMITTAL
      a. FILE FOLDER: 01 Table of Contents
         1) PDF File: Table of Contents
      b. FILE FOLDER: 02 Project Directory
         1) PDF File: Project Directory (organized as below):
            (a) Design Team
            (b) General Contractor
            (c) Sub-Contractors and Principal Vendors (organized by Division with project scope(s) listed for each Company)
      c. FILE FOLDER: 03 Contract Forms (organized and titled as below):
         1) PDF FILE: Substantial Completion, AIA G704

2) PDF FILE: Payment and Performance Bond
3) PDF FILE: Certificates of Liability Insurance
4) PDF FILE: Contractor's Affidavit of Payment of Debts and Claims, AIA G706
5) PDF FILE: Contractor's Affidavit of Release of Liens, AIA G706A
6) PDF FILE: Consent of Surety to Final Payment, AIA G707
7) PDF FILE: Contractor and Sub-contractors' Release or Waiver of Liens
8) FILE FOLDER: Change Orders
   (a) PDF FILES: (separate files for each Change Order, organized and titled in numerical order)

d. FILE FOLDER: 04 Certifications and Inspections (organized and titled as below):
1) PDF FILE: The correspondence from the Geotechnical Engineer, required by Section 01 1400 at the beginning of construction, indicating that the Construction Documents conform with their recommendations.
2) PDF FILE: The correspondence from the Special Inspection and Testing Agency (SITA), required by Section 01 1400 at the beginning of construction, indicating that the SITA accepted the responsibility to perform the specified SITA scope and meet the specified SITA qualifications
3) PDF FILE: The correspondence from the Commissioning Agent (CxA), required by Section 01 1400 at the beginning of construction, indicating that the CxA accepted the responsibility to perform the specified SITA scope and meet the specified SITA qualifications
4) PDF FILE: The "Acknowledgement of Contractor's Responsibilities Related to Code-Required Quality Control" required by Section 01 4533 at the beginning of construction.
5) PDF FILE: A copy of the written correspondence from the Contractor to the AHJ submitting the "Final Reports of Quality Control" required by Section 01 4533 from the SITA, CxA, and Code-Required Structural Observer. The copy of this correspondence shall include the actual reports and not just be a cover letter.
6) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the SITA
7) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the CxA
8) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the Code-Required Structural Observer
9) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the Structural Engineer
10) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the Mechanical Engineer
11) PDF FILE: The "Final Report of Quality Control" required by Section 01 4533 from the Electrical Engineer
12) PDF FILE: Certificates of Occupancy
13) PDF FILE: TEA Certificate of Project Compliance. File may be downloaded at https://tea.texas.gov/sites/default/files/cert_pre2004.pdf. Sample form is attached following this Section.
14) PDF FILE: Final Fire Inspection
15) PDF FILE: Final Health Inspection
16) PDF FILE: Final Elevator Inspection
17) PDF FILE: Final Building Inspection
18) PDF FILE: Accessibility Review Report
19) PDF FILE: Energy Code Compliance Letter
20) PDF FILE: HVAC Test and Balance Reports
21) PDF FILE: Backflow Test Report
22) PDF FILE: Data Testing Results

23) FLW FILE: Data Testing Results (Native)

e. FILE FOLDER: 05 Health/Safe Environment Data (organized and titled as below):
   1) PDF FILE: Asbestos-, Lead- and Hazardous-Free Material Certificates- or Letter
   2) PDF FILE: Material Safety Data Sheets (MSDS) (organized by Division)
   3) PDF FILE: Indoor Air Quality Test Reports

f. FILE FOLDER: 06 Additional Project Information
   1) FILE FOLDER: Requests for Information
      (a) PDF FILES (separate files for each RFI, organized and titled in numerical order)
   2) FILE FOLDER: Requests for Proposals
      (a) PDF FILES (separate files for each RFP, organized and titled in numerical order)
   3) FILE FOLDER: Approved Submittals
      (a) PDF FILES (separate files for each Submittal, organized and titled in numerical order by specification section)

g. FILE FOLDER: 07 Attic Stock
   1) PDF FILES: Attic Stock Sign-Off Sheets (separate files for each, showing Owner receipt, and organized and titled in numerical order by Specification Section)

h. FILE FOLDER: 08 Demonstration and Training
   1) FILE FOLDER: Sign-In Sheets
      (a) PDF FILES: (separate files for each, organized and titled in numerical order by Specification Section)
   2) FILE FOLDER: Training Videos
      (a) All training videos organized and titled in numerical order by Specification Section

i. FILE FOLDER: 09 Project Record Documents
   1) PDF FILE: Project Record Specifications Manual (organized and bookmarked by Division and by Specification Section) - include and hyperlink all Addenda, RFIs, RFPs, and In-Field Changes stamped as "As-Built" or "Record Documents".
   2) PDF FILE: Project Record As-Built Drawings (organized and bookmarked by Sheet Number) - include and hyperlink all Addenda, RFIs, RFPs, and In-Field Changes stamped as "As-Built" or "Record Documents".

j. FILE FOLDER: 10 Warranties
   1) FILE FOLDERS: (separate file folders, organized and titled by Division)
      (a) PDF FILES: (all warranty PDF files organized under each Division file folder and titled by Company Name)
      (b) PDF FILE: List of all warranties extending past one year. Include company name and contact information.

k. FILE FOLDER: 11 Operation and Maintenance Manuals
   1) PDF FILE: Keying Schedule
   2) PDF FILE: Shop Drawings (separate files for each, organized and titled by Specification Section)
   3) FILE FOLDER: Manuals
      (a) FILE FOLDERS: (separate file folders, organized and titled by Division)
      (b) PDF FILES: (all Manuals PDF files organized under each Division file folder and titled by Specification Section and scope)

3.06 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor has no responsibility for recording changes in the Work subsequent to Final Completion, except for changes resulting from work performed under Warranty.

3.07 CERTIFICATION OF PROJECT COMPLIANCE

CERTIFICATION OF PROJECT COMPLIANCE	Completion of this form is required under provisions of 61.1036(c)(3)(F) TAC for all public school district construction projects.

1. PROJECT INFORMATION DISTRICT:

Facility: ARCHITECT/ENGINEER:

Address: CONTRACTOR/CM:

City: CONTRACT DATE:

DATE DISTRICT AUTHORIZED PROJECT:

BRIEF DESCRIPTION OF PROJECT:

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 educational specifications of this facility along with the identified building code to be used have been provided to the architect/engineer.

DISTRICT: **BY:** **DATE:**

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, July 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER: **BY:** **DATE:**

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

CONTRACTOR/CM: **BY:** **DATE:**

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

DISTRICT: **BY:** **DATE:**

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SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and requiring routine maintenance where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Landscape irrigation.
   6. Audio and Visual systems.
   7. Lighting systems.
   8. Security systems and Access Controls.
   9. Fire Alarm systems.
   10. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Architect and Willis ISD.
   2. Submittals indicated as "Draft" are intended for the use of Owner in preparation of overall Training Plan; submit in editable electronic format, latest version of Microsoft Word required.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit not less than four weeks prior to start of training.
   2. Revise and resubmit until acceptable.
   3. Provide an overall schedule showing all training sessions.
   4. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
   1. Identification of each training session, date, time, and duration.
   2. Sign-in sheet showing names and job titles of attendees.
   3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
   4. Include Willis ISD's formal acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
   1. Format: DVD Disc.
   2. Label each disc and container with session identification and date.
   3. Provide sign-off sheets in the closeout documents indicating the individuals who were in attendance at each of the training sessions.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Willis ISD.

D. Provide training in minimum two hour segments.

E. The Willis ISD is responsible for determining that the training was satisfactorily completed.

F. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

G. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

H. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

I. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

J. Contractor must have written approval from the Owner and Architect to forgo any required trainings.

END OF SECTION

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SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements, furniture and equipment for alterations purposes.

C. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

B. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

C. Section 017000 - 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 013000 - 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 all paving and curbs within construction limits indicated on drawings.

B. Remove portions of existing concrete slabs as indicated on drawings.

C. Remove portions of existing walls as indicated on the drawings.

D. Remove portions of existing ceilings as indicated on the drawings.

E. Remove fences and gates.

F. Remove other items indicated, for salvage, relocation, and recycling.

G. 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 017000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.

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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.

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3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Unused underground piping may be abandoned in place provided it is completely drained and capped; remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 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 015000 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 equipmentas 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.

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3.05 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 4113
SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. SECTION INCLUDES:

1. Taking down, cutting away, breaking out and removing portions of the existing site to accommodate new construction.
2. Disconnecting, capping and removing identified utilities.
3. Offsite disposal and/or salvaging for reinstallation, indicated components.

B. RELATED SECTION

1. Section 01 1100 – Summary of Work: Instructions concerning hazardous materials
2. Section 01 5000 – Temporary Facilities and Controls
3. Section 01 7700 – Closeout submittal

1.02 PROJECT CONDITIONS

A. Occupancy: Owner will occupy the buildings and will inform Contractor. Conduct demolition work in manner that will minimize need for disruption of Owner's operations.

B. Existing Conditions: Owner assumes no responsibility for actual condition of items or structures to be demolished. Contractor shall visit the site and verify the nature and extent of demolition required. Conditions existing at time of commencement of contract will be maintained by Owner insofar as practicable.

C. Property Protection: Contractor shall be responsible for the protection of adjoining property, including all parts of the site outside the limits of demolition and outside the limits of the new construction. Protect buildings, paving, and utilities from damage by equipment and trucks. Various utilities are identified to be protected and remain in the drawings. Other utilities are to be protected until new services are installed.

1.03 SUBMITTAL

A. Submit demolition and removal procedures and schedule under provisions of SECTION 01 3216 – CONSTRUCTION PROGRESS SCHEDULES.

B. Submit record documents under provisions of SECTION 01 7700 – CLOSEOUT SUBMITTALS. Accurately record actual locations of capped utilities and subsurface obstructions.

1.04 EXISTING CONDITIONS

A. Conduct demolition to minimize interference with adjacent portion of site to remain.

B. Conduct operations with minimum interference with Owner's usage of buildings. Maintain protected egress and access at all times and maintain protected egress at fire exists as required by the Fire Marshall.

C. Underground utilities are shown on plans based on survey and city information. Contractor should assume there are underground utilities not shown on plans.

1.05 PROTECTION

A. It is essential that there be minimal interruptions of existing utilities. Any disruption of service to the owner or adjoining properties must not be done without written notification and approval.

B. Take care to ensure that there will be no damage to elements or portions thereof which are not required to be removed. Erect and maintain temporary shoring, bracing, and other means to

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safeguard the structural integrity of the existing portions of site and its parts to remain.

C. Erect and maintain temporary bracing, shoring, lights, barricades, signs and other means to protect workers and other persons, and finishes and improvements to remain from damage; all in accordance with applicable regulatory requirements.

D. Protect existing trees to remain. Keep area within the drip line clear of construction traffic, parking, soil contaminations, soil stockpiling, storage of materials, debris and ponding water. Locate temporary fencing around trees to remain along dripline.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable building codes for disposal of debris.

B. Coordinate clearing Work with Owner and utility companies. Contact utility locates, which includes DIGTESS for franchise utilities and the City for public utilities

C. Conform with applicable portions of OSHA, including 1926.604.

PART 2 – PRODUCTS

2.01 GENERAL

A. Materials designated for demolition shall become the Contractor's property; remove and dispose of such materials unless otherwise indicated or specified. Sales of salvage materials are not allowed on site.

B. Items to remain the Owner's property will be removed by him prior to the start of demolition (or will be designated on the drawings herein or to be removed and stored by Contractor). Items not so designated shall be considered debris and shall be removed and disposed of accordingly.

C. Carefully disconnect, remove and protect items directed by the Owner to be salvaged.

D. Transport salvaged items to on-site storage areas designated by the Owner.

PART 3 – EXECUTION

3.01 INSPECTIONS

A. Prior to starting demolition, make inspection and report observable defects and structural weaknesses of construction designated for demolition, of adjacent structures, and of improvements to remain. If unsatisfactory conditions exist, do not commence demolition until appropriate determinations have been made.

B. Following demolition, make inspection and report defects and structural weaknesses of items partially demolished, cut, or removed, of adjacent structures; and or improvements remaining.

3.02 PREPARATION

A. Prevent movement or settlement of adjacent structures. Provide bracing, shoring and underpinning as required.

B. Protect existing appurtenances, structures and landscaping which are not to be demolished.

C. Locate, disconnect, remove and cap designated utility lines within demolition areas.

D. Mark location of disconnected utilities. Identify utilities and indicate capping locations on Project Record Documents.

3.03 PERFORMANCE

A. Demolition: Carry out the work carefully and in an orderly manner to minimize noise, dust and vibration. Remove all items and parts so shown and noted on the drawings and as otherwise may be required to be removed to carry out the work.

B. Clearing:

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1. Remove trees, shrubs and other vegetation from within the area of the site where new construction is to be placed. Grub out roots to a depth of at least 18 inches below natural grade.

   Dig out and remove buried obstructions to a depth of 24 inches below natural grade or 24 inches below the intended excavation elevation, whichever is lower. Remove existing trash, debris and abandoned facilities, which are to be removed from the site.

2. Remove abandoned underground utilities from within the area of the site where new construction is to be placed. Cut and cap piping and conduit encountered below grade that is outside the limits of new construction. Relocate, outside of new construction areas, utility services for buildings to remain in operation.

3. Prior to the removal of any buildings, verify all the utility services are disconnected and coordinate with the Architect on protecting any building(s) to remain.

3. Clear undergrowth and deadwood, without disturbing subsoil.

4. Burning debris on site is not permitted.

5. Remove debris, rock, fences, and extracted plant life from site.

C. Shoring: Provide temporary shoring wherever present supports are removed or weakened. Any settling or cracking of the existing construction due to the removal of supports and faulty or insufficient shoring shall be the responsibility of the contractor and shall be repaired at no additional expense to the Owner.

D. Material and Equipment Disposal:

1. The materials and items of equipment which are noted and shown to be salvaged and re-used in new locations or re-used for patching shall be carefully removed and safely stored until ready for reinstallation.

2. Other items and all debris shall become the property of the Contractor and shall be removed from the premises entirely. Under no circumstances shall debris be allowed to accumulate.

E. Damage: Any existing construction to be left in place which is damaged by the demolition operations shall be refinished or replaced at no additional expense to the Owner. The repair of such damage shall leave the parts in a condition at least equal to that found at the start of the work.

F. Perform demolition in accordance with ANSI 10.6 and applicable regulatory requirements.

G. Remove items designated for demolition within the limits of work indicated and as required to perform the work. Do not remove anything beyond the limits of demolition indicated without the prior written approval of Architect. If in doubt whether to remove an item, obtain written approval prior to proceeding.

H. If in the event hazardous materials (asbestos, PCB's etc.) are encountered during the course of the demolition work, or if it is even suspected that such materials will or have been encountered cease work immediately in the affected area and promptly notify the Owner and Architect.

I. Remove all building foundation systems four feet (4') minimum below existing ground.

J. Remove all trees and associate roots to 2 feet (2') minimum below existing ground.

K. Remove all existing underground utilities within limits of demolition. Cap utilities at property line. Call for locates and use other means as deemed necessary to locate, identify and demolish.

3.04 CUTTING

A. Make new openings neat, as close as possible to profiles indicated and only to extent necessary for new work.

B. At concrete paving and other materials where edges of cuts and holes will remain exposed in the completed work, make cuts using power-sawing and –coring equipment. Do not over-cut at corners of cut openings.

C. Upon completion of cutting and coring, clean remaining surfaces of loose particles and dust.

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3.05 PIPES, DUCTS AND CONDUITS

A. Remove deactivated mechanical, plumbing and sprinkler piping, ducts and electrical conduit, including fastenings, connections and other related appurtenances and accessories which would otherwise be exposed in the completed work or interfere with construction operations.

B. Cap deactivated piping systems at points of cutoff.

3.06 CLEAN UP

A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

3.07 SURVEY

A. Provide as-built survey of any foundation systems or other underground improvement exposed but left in place. Use same control as original survey and deliver to the architect in a CAD file.

END OF SECTION

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SECTION 031000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete.

B. Form accessories.

1.02 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete.

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. ACI 347R - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

E. PS 1 - Structural Plywood; 2019.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials and installation requirements.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, arrangement of joints and ties, and minimum soil retainer bearing lengths above the bottom of the grade beam and below the bottom of the void as calculated per the formowrk accessories section below.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

C. Protect plastic foam products from damage and exposure to sunlight.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Comply with relevant portions of ACI 301, ACI 301, and ACI 301.

2.02 WOOD FORM MATERIALS

A. Wood forms for unexposed concrete surfaces - No. 2 Common Southern Yellow Pine Lumber or other material of equal qualifications of sufficient thickness to be capable of sustaining the loads to be imposed thereon, dressed to uniformly smooth contact surfaces.

B. Wood forms for exposed concrete surfaces - Commercial Standard Douglas Fir, moisture-resistant, concrete form plywood with one smooth face.

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2.03 FORMWORK ACCESSORIES

A. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied. Verify that formo release agents or addtives do not inhibit the adhesion capabilities of building enclosure components.
   1. Composition: Colorless mineral oil-based compound.

B. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

C. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard or felt, complying with ASTM D 1751, 1/2 inch thick and full depth of slab less 1/2 inch .

D. Waterstops: See section 03 3000 - Cast-in-Place Concrete.

E. Expanded Polystyrene (EPS) Geofoam:
   1. Lightweight expanded polystyrene with a minimum compressive strength of 2.2 pounds per square inch (psi) at a 1% deformation.
   2. Geofoam shall be in compliance with ASTM D 6817.
   3. Geofoam shall be shaped to provide continuous support for raised slabs or to act as a lightweight fill material at locations indicated on the drawings.
   4. Manufacturers:
      a. Foam-Control EPS Geofoam, AFM Corporation: www.geofoam.com
      b. InsulFoam GF, Insulfoam, LLC.: www.insulfoam.com
      c. Therma Foam: www.thermafoam.com

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Earth formed grade beams allowed only where noted in the Structural Drawings. Grade beams shall be FORMED ON ALL structural slabs and exposed conditions. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Refer to the Civil Drawings for construction joint requirements at flatwork.

E. Construction joints: Locate construction joints in concrete as indicated. Contractor shall obtain written approval for all construction joints not shown on Drawings for structural concrete. Distance between construction joints shall be arranged so that the greatest horizontal dimension (including diagonal measurement) for slab pours shall not exceed 200 feet. Provide keyways and extra dowels at all joints. Provide longitudinal keys at joints.

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F. Expansion joints: Expansion joints shall consist of joint fillers with sealant. Install filler strips 3/4" below finished surfaces. Clean grooves when surface is dry of foreign matter, loose particles and concrete protrusions; then fill approximately flush with joint sealant to be slightly concave after drying. Finish edges of exposed concrete along expansion joints around all fixed objects within or abutting concrete.

G. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect/Engineer before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.06 FIELD QUALITY CONTROL

A. A special inspections and testing agency (SITA) will perform field quality control tests and inspections, as specified in Sections 01 4516 and 01 4533.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.07 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

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SECTION 032000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories.

B. Section 033000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 301 - Specifications for Concrete Construction; 2020.

B. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).

C. ACI SP-66 - ACI Detailing Manual; 2004.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

E. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2016.

F. CRSI (DA4) - Manual of Standard Practice; 2009.

G. CRSI (P1) - Placing Reinforcing Bars, 10th Edition; 2019.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Include bar schedules, shapes of bent bars, spacing of bars, location of splices and embedded metal assemblies.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 318, ACI 318, ACI 301, ACI 318, and ACI 318.
   1. Maintain one copy of each document on project site.

B. Provide Architect with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

C. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Deformed billet-steel bars.
   2. Unfinished.
   3. Splicing of pier reinforcement shall not be permitted.

B. Weldable Reinforcing Steel: ASTM A 706, deformed low-alloy steel bars.
   1. Unfinished.

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C. Steel Welded Wire Reinforcement (WWR): Plain Type; 1.
   1. Form: Flat Sheets.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement. At slabs, supports shall not be further than 48 inches apart, each way.
   3. Provide plastic or plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI SP-66 - ACI Detailing Manual.

B. Welding of reinforcement is not permitted, unless explicitly indicated on Structural Drawings

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
   1. Review locations of splices with Architect.
   2. Approved patented type splices (No Electric Arc Welding Permitted) may be used instead of lap splices.
   3. Any bar may be field bent one time without notfiying the Structural Engineer, unless noted otherwise on the Structural Drawings. Reinforcement smaller than #4 bars shall be cold bent. Reinforcement greater than #4 bars shall be bent with heat in the field. Heating shall be controlled by temperature indicating crayons and shall reach a maximum temperature of 1500 degrees Farenheit. Reinforcement shall not be artificially cooled until temperature has reduced naturally to below 600 degrees Farenheit. Bends shall be gradual and care shall be taken to prevent heating or cracking of concrete. If reinforcement must be field bent more than once, the Contractor shall issue an RFI indicating which bars need to be field bent additionally.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Placement of reinforcing steel shall be done in cooperation with requirements of other trades. No cutting of reinforcement or displacement of bars shall be done by any of the trades without the consent of the Architect, and then only when adequate reinforcement is provided to replace the design requirements.

E. Use templates to locate all column and footing dowels.

F. Maintain concrete cover around reinforcing as indicated on drawings.

G. Bond and ground all reinforcement to requirements of Section 260526.

3.02 FIELD QUALITY CONTROL

A. A special inspections 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 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete building frame members.

B. Concrete for composite floor construction.

C. Floors and slabs on grade.

D. Concrete Floor Topping and Feathering Material.

E. Joint devices associated with concrete work.

F. Miscellaneous concrete elements, including equipment pads, equipment pits, light pole bases, flagpole bases, thrust blocks, and manholes.

G. Concrete curing.

H. Under-Slab Vapor Barrier

I. Concrete Mix Design Requirements

1.02 COORDINATION OF CIVIL AND STRUCTURAL CONCRETE SPECIFICATIONS

A. This specification section applies to all concrete designs provided on the Structural Drawings. For clarification, this specification section applies to interior and exterior concrete designs provided on the Structural Drawings (possibly including but not limited to sidewalks, patios, pavement, ramps, stairs, retaining walls, etc.). For exterior concrete designs not shown on the Structural Drawings but shown on the Civil Drawings, the provisions of this specification section only applies when there is not a conflicting specification elsewhere in in the Project Manual or Civil Drawings.

1.03 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 032000 - Concrete Reinforcing.

C. Section 03 3543 - Bonded Abrasive Polished Concrete Floors

1.04 REFERENCE STANDARDS

A. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials; 2006.

B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

C. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.

D. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

E. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

F. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2018.

G. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2023.

H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

I. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

J. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

K. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

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L. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2017a.

M. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

N. ASTM C595/C595M - Standard Specification for Blended Hydraulic Cements; 2021.

O. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

P. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.

Q. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004, with Editorial Revision (2013).

R. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2019).

S. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

T. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

U. ASTM F1249 - Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor; 2025.

V. COE CRD-C 48 - Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete; 1992.

W. COE CRD-C 572 - Handbook for Concrete and Cement Corps of Engineers Specifications for Polyvinylchloride Waterstop; 1974.

X. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems; 2021, with Editorial Revision (2022).

Y. NSF 61 - Drinking Water System Components - Health Effects; 2022, with Errata.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. The Contractor shall submit all proposed mix designs in accordance with ACI 301 to the Architect for review before use. Each mix design shall clearly identify where the Contractor proposes use, such as indicating “Drilled Piers”, “Auger Cast-In-Place Piles”, “Concrete Columns”, “Insulating Concrete Formed Walls”, "Cast-In-Place Concrete Retaining Walls", "Precast Tilt Wall Panels", “Light Pole Bases”, “Grade Beams”, “Interior Slabs on Grade & Interior Slabs on Metal Deck”, “Interior Slabs on Void Boxes and Interior Slabs on Temporary Formwork”, “Exterior Slabs on Grade, Exterior Slabs on Metal Deck and Miscellaneous Concrete”, “Exterior Slabs on Void Boxes and Exterior Slabs on Temporary Formwork”, "Storm Shelter Roof Topping Slab", “Greenhouse Foundations”, “Freezer Slabs & Cooler Slabs”, “Crawlspace Mudslab”, etc. Failure to clearly identify where mixes are proposed for use is a suitable reason for rejection. To expedite approval it is suggested that all mix designs related to Structural items be submitted separately from all mix designs related to Civil items as these two categories are reviewed by different parties. Furthermore, to expedite approval, it shall be permitted to email Structural Mix Designs directly to the Structural Engineer or Record and request approval.

C. It shall be required to submit new mix designs for approval when changes to brand, type, size, or source of cementitious material, aggregates, water, ice, or admixtures are proposed or necessary.

D. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. For curing compounds, refer to Submission requirements below before products shall be permitted and provide letters of acceptance from the flooring subcontractor and provide data on method of removal in the event of incompatibility with floor covering adhesives.
   2. Concrete Admixtures: For each proposed mix design, provide a written statement from each admixture manufacturer that is used in the concrete mixture that:
      a. Each mixture meets the governing ASTM standing for the admixture.
      b. The manufacturer's understanding of the intended use of the admixture (e.g. air entraining agent, water reducing agent, retarding agent, etc.), the manufacturer's understanding of the purpose range of dosages in the concrete mixture, and that the manufacturer recommends the use of the proposed admixture(s) or the intended purpose.
      c. Each proposed admixture is compatible with each of the constituents of the mixture (e.g Type of cement, and supplementary cementitious materials, other proposed admixtures in the mix, etc).
      d. The proposed combination of admixtures will not result in effects that are detrimental to the strength, workability, or durability of the concrete.
      e. The proposed combination of admixtures will not increase the shrinkage potential of the concrete mixture from that of the concrete mixture without any admixtures.
      f. The use of the proposed admixtures will not cause the concrete to have a chloride ion content greater than specified.
      g. The proposed admixtures do not contain more than 25% lignosulfonates.
   3. For vapor barriers, submit all of the following:
      a. Product data and installation instructions.
      b. Documentation from the manufacturer or patent-holder indicating that:
         1) The product is a minimum 15 mil product;
         2) The product is suitable for installation in contact with soil or granular fill under concrete slabs;
         3) Where a concrete-adhering tape is specified for use (e.g. over voidforms), both the vapor barrier product manufacturer or patent-holder and the concrete-adhering tape manufacturer or patent-holder have indicated that the concrete-adhering tape is compatible with the submitted vapor barrier product, and that test data indicates the tape will adhere to the concrete with a minimum 12 pounds per linear inch of tape.
      c. Documentation from an independent agency indicating that:
         1) The independent agency is a testing firm or professional engineering firm which shares no ownership with the product manufacturer or patent-holder;
         2) The independent agency randomly selected the samples for testing from one or more warehouses (or other distribution locations) and then shipped the samples to one or more testing laboratories;
         3) Testing was completed within four years before construction proposals are due for this project, by one or more independent testing laboratories;
         4) The testing fully complied with ASTM E 1745 or identifying any deviations from ASTM E 1745 (including deviations from any documents referenced by ASTM E 1745), with permeance testing having at least two sample replicates (instead of the three required by ASTM E 1745) for each of the five permeance testing scenarios required (baseline and the four conditions required by ASTM E 154 Sections 8, 11, 12 and 13);
         5) The puncture, tensile strength and permeance results of the testing comply with the requirements for a 15 mil, Class A vapor barrier according to ASTM E 1745; and,

6) The average permeance of all samples tested for each of the five permeance testing scenarios is less than or equal to 0.010 Perms [grains/(sq ft*hr*in.Hg)] (with the permeance results being considered to the nearest 0.001 Perm) per ASTM F 1249 after mandatory conditioning tests per ASTM E 154 Sections 8, 11, 12 and 13.

E. Saw-Cut Plans: Submit proposed saw-cut locations for slab on grade and topping slabs to the architect and structural engineer of record. Saw-cuts in slab over void space are not permitted.

F. Control Joint Plans: Submit proposed control joint locations to the structural engineer of record.

G. Samples: Submit samples of underslab vapor barrier and tape to be used if making a substitution request.

H. Test Reports: Submit report for each test or series of tests specified.

I. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

J. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. For slabs that require under slab vapor barriers, Contractor shall contact manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 031000.

2.02 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 032000.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150 or ASTM C 1157, Type I/II Portland type.
   1. Acquire cement for entire project from same source.

B. Blended Hydraulic Cement: ASTM C595/C595M, Type IL Portland-Limestone Cement
   1. Acquire cement for the entire project from the same source.

C. Fine and Coarse Aggregates: ASTM C33/C33M (Except as Noted)
   1. Acquire aggregates for entire project from same source.
   2. Fine aggregate:
      a. Provide washed natural or manufactured sand having strong, hard, durable particles, and containing not more than 2% by weight of deleterious matter such as clay lumps, mica, shale, or schist.
   3. Coarse aggregate:
      a. Provide coarse aggregate consisting of clean, hard, find grained, sound crushed rock or washed gravel, or a combination of both, containing not more than 5% by weight of flat, chip-like, thin, elongated, friable, or laminated pieces, nor more than 2% by weight of shale or cherty material.

b. Unless noted otherwise, the nominal aggregate size shall be the largest practicable size for each condition of placement, subject to the lesser of the following maximum size limitations:
   1) 3/4" for slabs over void boxes
   2) 1/2" for Tilt-up concrete wall panels
   3) 3/8" for ICF walls
   4) In all cases, do not exceed 3/4 of the clear distance between reinforcing bars, 3/4 of the specified clear cover, 1/5 of the narrowest dimension between sides of forms, or 1/3 of the depth of any slab section.

c. For each mix design submittal (excluding pavement designed by the Civil Engineer and shown on the Civil Drawings): The concrete supplier shall provide a combined (coarse and fine) sieve analysis for the proposed aggregate blend, using sieve data measured within the past 3 months. It shall be permitted for the concrete supplier to submit a combined sieve analysis that is calculated based on individual sieve analyses.
   1) The combined sieve analysis shall show the percent retained on each sieve (not the cumulative percent retained) and shall meet the following requirements:
      (a) Sizes: 1 1/2", 1", 3/4", 1/2", 3/8", #4, #8, #16, #30, #50, #100, #200.
      (b) No sizes other than those listed shall be on the analysis.
      (c) 0% shall be retained on the 1 1/2" sieve.
      (d) 0% to 16% shall be retained on the 1" sieve.
      (e) 0% to 20% shall be retained on the 3/4" sieve.
      (f) 4% to 20% shall be retained on the 1/2", 3/8", #4, #30, and #50 sieves.
      (g) 0% to 12% on the #8 and #16 sieves.
      (h) 0% to 16% shall be retained on the 1" sieve.
      (i) 5% to 10% shall be retained on the #100 sieve.
      (j) 0% to 2% on the #200 sieve.
      (k) The combined percent retained on the #30, #50, #100, and #200 sieve shall be 25% to 40%.
      (l) The combined percent retained on the #8, #16, and #30 sieves shall not be greater than 20%.
         (1) Exception: The percent retained shall be 0% for all sieves larger than the specified nominal maximum aggregate size for an individual mix.
   2) If the percent retained requirements above cannot be met by using multiple aggregate piles from the plant, the Contractor shall assume for bidding purposes that outside sources will be required.
   3) The requirements of the combined sieved analysis set forth in item 1 may exceed or be more stringent than the requirements set forth in ASTM C33/C33M
   4) When concrete is pumped, the inside diameter of the pipeline shall be a minimum of 3-times the specified maximum nominal aggregate size. Do not use smaller aggregate sizes to accommodate smaller pipe diameters.

D. Lightweight Aggregate: ASTM C330/C330M.

E. Fly Ash: ASTM C618 C or F

F. Water: ASTM C94/C94M or potable.

G. Concrete Floor Topping and Feathering Material:
   1. This item applies to concrete topping slabs with a thickess of 3-inches or less
   2. At feathered locations, provide cement-based self-leveling underlayment.
   3. Provide manufacturer's recommended primer for standard absorbent concrete.
   4. Aggregate shall be well graded, washed gravel (1/8" to 1/4" or larger) for use when underlayment is installed over 1 1/2" thick.
   5. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).

6. Acceptable Manufacturers: Subject to compliance with requirements herein, provide products from one of the following manufacturers.
    a. Ardex Engineered Cements: www.ardex.com
    b. (Level-Right) Maxxon Corporation: www.level-right.com
    c. Bonsal American: www.bonsal.com
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in, including calcium chloride, excess of 0.1 percent by weight of cement.

B. Dispense in compliance with manufacturer's recommendations with particular attention to possible undesirable chemical reaction between products when mixed in concentrated form.

C. Do not use admixtures that contain more than 25% lignosulfonates.

D. Do not use admixtures or a combination of admixtures that will increase the shrinkage potential of concrete.

E. Air Entrainment Admixture: ASTM C260/C260M.

F. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
    1. Manufacturers:
        a. MasterGlenium 1466 by BASF Corporation.
        b. Substitutions: See Section 016000 - Product Requirements.

G. Mid-Range Water Reducing Admixture: Complying with ASTM C494/C494M Type A and/or Type F and having a maximum of 25% lignosulfonates.
    1. Manufacturers:
        a. POLYHEED 1020 by Degussa Admixtures
        b. SIKAMENT 686 by Sika (214) 878-3669
        c. PLASTOL 341 by Euclid Chemical Co. (216) 531-9222
        d. POZZOLITH 200N by BASF Corporation
        e. MasterGlenium 1466 by BASF Corporation
        f. Substitutions: See Section 01 6000 - Product Requirements. A letter from the manufacturer will be required indicating that the material does not have more than 25% lignosulfonates.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Barrier shall meet all of the following requirements:
    1. The product shall be a minimum 15 mil product.
    2. The product shall be suitable for installation in contact with soil or granular fill under concrete slabs according to the manufacturer or patent-holder.
    3. Terminate vapor barrier at building perimeter and interior pilasters, pier caps, or footings per manufacturer’s recommendations. Do not install vapor barrier between concrete interface at construction joints (e.g. between perimeter grade beam and slab or between pilasters/pier caps and slabs).

4. Within four years before construction proposals are due for this project, an independent agency (a testing firm or professional engineering firm which shares no ownership with the product manufacturer or patent-holder) shall have randomly selected the samples for testing from one or more warehouses (or other distribution locations) not wholly, or partially owned by the manufacturer, and then shipped the samples to one or more testing laboratories which then completed testing in compliance with ASTM E 1745 having at least two sample replicates (instead of the three required by ASTM E 1745) for each of the five permeance testing scenarios required (baseline and the four conditions required by ASTM E154/E154M Sections 8, 11, 12 and 13), with the puncture, tensile strength and permeance results of the testing complying with the requirements for a 15 mil, Class A vapor barrier according to ASTM E1745, and the average permeance of all samples tested for each of the five permeance testing scenarios being less than or equal to 0.010 Perms [grains/(sq ft*hr*in.Hg)] (with the permeance results being considered to the nearest 0.001 Perm) per ASTM F1249 after mandatory conditioning tests per ASTM E 154 Sections 8, 11, 12 and 13. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1
5. Accessory Products: At slabs on grade and over the subgrade of all crawlspaces, install vapor barrier manufacturer’s recommended tape for sealing perimeter, seams and penetrations in vapor barrier. At slabs poured over carton void forms, install the vapor barrier over the Masonite and tape all joints (and tape the perimeter of the vapor barrier under the slab area) with a tape that bonds to the concrete with a minimum tensile strength of 2 psi (12 lbf/in using a 6” wide tape) equal to Stego Crete-Claw Tape as manufactured by Stego Industries (877) 464-7834 and if the same manufacturer does not provide both the vapor barrier and the tape, a letter from both manufacturers of the vapor barrier and tape shall be submitted to the Architect indicating that both products are compatible. At all areas where vapor barrier is installed, install the vapor barrier manufacturer’s recommended adhesive, mastic, prefabricated boots, etc.
6. Manufacturers and/or Patent-Holders: The following manufacturer(s) are approved, with manufacture's test data expiration date as indicated. Products listed below may not be used if manufacture's test data has expired.
    a. Poly-America; Husky Yellow Guard 15-mil Vapor Barrier: www.yellowguard.com/#sle. (Manufacture's test expires June 2027.)
    b. Stego Industries, LLC: www.stegoindustries.com. (Stego 15 mil - Class A) (Manufacture's test expires in March 2025)
    c. Substitutions: See Section 01 6000 - Product Requirements.

B. At slabs over crawlspace, unless specifically noted otherwise, crawlspace shall consist of 3" thick unreinforced mud slab. If crawlspace grading indicates locations where mud slab is not required, provide vapor barrier noted above covered with 2" of 3/8" diameter pea gravel.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

B. Epoxy Bonding System:
1. Complying with ASTM C881/C881M and of Type required for specific application.

C. Waterstops: Self-sealing, non-swelling preformed joint sealant.
1. Single component, self-sealing adhesive compound, extruded in a square cross-section between two quick-release protective wrappers.
    a. Meets Federal Specification SSS-210
    b. Certified NSF/ANSI Standard 61 for use in potable water systems
    c. Manufacturers:
        1) Henry Company; Synko-Flex Waterstop: www.us.henry.com
        2) Substitutions: See Section 016000 - Product Requirements.
2. Flexible PVC Waterstop. Dumbbell Configuration.

a. Certified NSF/ANSI Standard 61 for use in potable water systems
b. Manufacturers:
1) Sika USA; Greenstreak Waterstop: usa.sika.com
2) Substitutions: See Section01 6000-Product Requirements.

D. Reglets: See Section 03 1000 - Concrete Forming and Accessories

E. Joint Filler: See Section 03 1000 - Concrete Forming and Accessories

F. Slab Construction Joint Devices: See Section 03 1000 - Concrete Forming and Accessories

2.07 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
1. Manufacturers:
a. W. R. Meadows, Inc; Evapre or Evapre-RTU: www.wrmeadows.com/#sle.

B. At all building slabs, except locations where a "sealer" is shown on the Architectural Drawings: Wet Curing with Potable Water that is not detrimental to concrete.
1. Unless otherwise approved as a substitution request, Proposers shall assume for Proposal purposes that curing compounds shall not be used anywhere on this project and that only wet curing shall be permitted. However, if requested as a substitution request, the Architect may elect to permit this material at certain locations if the Contractor verifies that the warranty will be met: Curing Compound, Naturally Dissipating, Clear, water-based, liquid membrane-forming compound, that dissipates within 3 to 5 weeks; complying with ASTM C309.Note: Many flooring installer Subcontractors will no longer warranty flooring if any kind of curing compound is used! It is the Contractor's responsibility for verifying compatibility of flooring materials and adhesives with any proposed curing compound before proposing curing compounds.

C. At all building slabs where a "sealer" is shown on the Architectural Drawings: Curing and Sealing Compound, Semi-Gloss: Liquid, membrane-forming, dries clear, non-yellowing acrylic-based polymer; complying with ASTM C1315 Type 1 Class A.
1. Vehicle: Solvent-based.
2. Solids by Mass: 25 percent, minimum.
3. VOC Content: Ozone Transport Commission (OTC) compliant.
4. Manufacturers:
a. BASF; MasterKure CC 250 SB: www.master-builders-solutions.basf.us
b. W.R. Meadows, Inc.; CS-309-25 OTC: www.wrmeadows.com.
c. Substitutions: See Section 016000 - Product Requirements.

2.08 CONCRETE MIX DESIGN REQUIREMENTS

A. Note to Building Official: The specified air contents for this project are based on the interpretation that all concrete on this project is under Exposure Category F0 conditions in which Freezing and Thawing concerns are "Not Applicable". The International Building Code requires that air contents of concrete be within ranges specified by ACI 318 for various Exposure Categories depending on the probability of exposure to moisture before freezing, and probability of cycles of freezing and thawing. ACI Commentary describes F0 as concrete that will not be exposed to cycles of freezing; F1, exposed to cycles of freezing and thawing that will be occasionally exposed to moisture before freezing; F2, exposed to cycles of freezing and thawing that is in continuous contact with moisture before freezing; and F3, similar to F2 with exposure to deicing chemicals. The "not applicable" interpretation for this project is based on the very limited number of freeze thaw cycles that are likely to occur at this project and based on the consideration that high air contents can cause problems such as cracking and surface delamination.

B. Refer to the schedule of mixes at the end of this specification section for requirements specific to different applications. It shall be permitted to submit to the Engineer any desired proprietary designs which deviate from the schedule of mixes if and only if all deviations from the schedule are clearly noted and if test data is provided indicating the performance of the concrete with regard to slump versus time, strength versus time, and air content.

C. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

D. Establish required average strength for each type of concrete on the basis of field experience, as specified in ACI 301. It shall be an obligation of the Contractor to produce and deposit concrete that will exceed specified strength twenty-eight days after placing. Concrete falling below specified strength required by ACI 318, as shown by cylinder test shall be removed by the Contractor and be replaced with concrete at specified strength at no cost to the Owner unless otherwise approved by the Engineer after evaluation.

E. Concrete may be proportioned and mixed at the job, dry-batched and mixed at the job or be procured from a ready-mixed concrete plant. Whatever the method of production, concrete materials and concrete shall be stored handled and mixed in conformance with all requirements of ASTM C94, which apply to the particular method selected.

F. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

G. Aggregate: As specified in Section 2.03 B.

2.09 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements Section 03 1000 - Concrete Forming and Accessories.

B. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   2. Use latex bonding agent only for non-load-bearing applications.
   3. At intersections of pours for concrete walls and beams (including foundation elements such as grade beams), install a 1 1/2" deep keyway that is a minimum of 1/3 the thickness and 1/3 the height (unless otherwise noted) and roughen the exposed surface of the first pour with a minimum 1/4" amplitude.

C. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

D. Vapor Barrier: At exterior floor slabs where indicated on the Structural Drawings Sheets and Notes and at all interior floor slabs, a vapor barrier under the floor slab shall be installed in accordance with ASTM E 1643 and as indicated in Part 2 of this Specification Section. Lap joints minimum 6 inches. Repair damaged vapor retarder before covering.

1. Install compactible granular fill before placing vapor barrier at areas where slabs are poured on grade. Install void boxes and masonite before placing vapor barrier at areas where slabs are to be poured on void boxes. Do not place sand between the vapor barrier and the slab.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of Section 03 2000 - Concrete Reinforcing.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R and ACI 302.2R

C. Notify Architect not less than 48 hours prior to commencement of placement operations.

D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

E. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

E. Separate slabs on grade from vertical surfaces with joint filler as indicated on drawings.

F. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

G. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07 9200 for finish joint sealer requirements.

H. Install joint devices in accordance with manufacturer's instructions.

I. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

J. Install joint device anchors for expansion joint assemblies specified in Section 07 9513. Maintain correct position to allow joint cover to be flush with floor and wall finish.

K. Apply sealants in joint devices in accordance with Section 07 9200.

L. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

M. Place concrete continuously between predetermined expansion, control, and construction joints.

N. Deposit concrete continuously or in layers of such thickness that no concrete will be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within sections.

O. Do not interrupt successive placement; do not permit cold joints to occur.

P. Placing of concrete in supported elements shall not be started until concrete previously placed in columns and walls is no longer plastic.

Q. Consolidate concrete by vibration, spading or rodding, so that concrete is thoroughly worked around reinforcement, around embedded items and into corners or forms, eliminating all air or stone pockets that may cause honeycombing, pitting or planes or weakness.

R. Place saw-cuts in slabs-on-grade and topping slabs in saw cut pattern indicated. Saw-cuts in slab over void space are not permitted.

S. Saw cut slab-on-grade and topping slab joints within 4 hours after placing. Use maximum 3/16 inch thick blade, cut into slab 1/4 depth of slab thickness. Saw-cuts in slab over void space are not permitted.

T. Screed slabs on grade level, maintaining surface flatness of maximum 1/4 inch in 10 ft.

3.06 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.

E. Place concrete floor toppings to required lines and levels.

F. Screed toppings level, maintaining surface flatness of maximum 1:1000.

3.07 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 feet.
   2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
   3. Under Carpeting: 1/4 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.08 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as indicated on drawings and as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
   2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.

D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.
   2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
   3. Other Surfaces to Be Left Exposed: "Steel trowel" as described in ACI 302.1R, minimizing burnish marks and other appearance defects.
   4. Broom Finish: Ramps, stair treads, sidewalks, porches and docks, concrete pads, Storm Shelter Roof Topping and bases for mechanical equipment. Steel trowel smooth. Brush after troweling with a soft bristle broom to create non skid surfaces perpendicular to the direction of travel.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

3.09 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than seven days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Floor and Roof Slabs To Receive Adhesive-Applied Flooring or Roofing: Curing compounds and other surface coatings are usually considered unacceptable by flooring manufacturers, adhesive manufacturers, and roofing installers. If use of such materials is desired by the Contractor, the Contractor shall either obtain the approval of the flooring manufacturer and adhesive manufacturers, or roofing installer prior to use. Alternatively, the Contractor shall remove the surface coating after curing to flooring manufacturer's or roofing installer's satisfaction. Unless otherwise approved as a substitution request, the Contractor shall assume during bidding that curing compounds shall not be used anywhere on this project and that only wet curing shall be permitted. However, if requested by the Contractor as a substitution request or during construction, the Architect may elect to permit this material at certain locations. Generally, the Architect will require a letter from the flooring subcontractor or roofing installer guaranteeing that the curing compound is compatible with the flooring adhesive and flooring materials or roofing system.
   2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than seven days or until the concrete has reached 70% of the specified 28-day strength by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
      a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously.
      b. Spraying: Spray water over floor slab areas and maintain wet.
      c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.

3.10 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. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

3.11 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.12 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

3.13 SCHEDULE - CONCRETE MIX DESIGN REQUIREMENTS

A. "Footings and Plinths" Mix: 3,000 psi 28 day concrete, 4" to 6" slump, 4.5% +/- 1.5% air content using air entraining agent as required, minimum 5 sacks of cement per cubic yard, up to 20% replacement of cement with Class C or Class F fly ash permitted. Mid range and high range water reducing agents permitted.

B. "Interior Slabs on Grade" Mix: 3,000 psi 28 day concrete, maximum water to cement ratio of 0.5, 5" to 6" slump (Note: This is more stringent than the default ACI tolerance for slump), 1.5% +/- 1.5% air content, air entraining agent not permitted, minimum 5 sacks of cement per cubic yard with up to 20% replacement using Class F fly ash permitted, mid range water reducing agents permitted, high range water reducing agents not permitted. The slab aggregate gradation requirements in Section 2.03 B shall apply. If any portion of concrete is will be permanently in contact with exterior elements, Miscellaneous Concrete mix design shall apply.

C. "Miscellaneous Concrete" Mix: 3,000 psi 28 day concrete, maximum water to cement ratio of 0.50, 5" to 6" slump (Note: This is more stringent than the default ACI tolerance for slump), 4.5% +/- 1.5% total air content using air entraining agent, minimum 5 sacks of cement per cubic yard, up to 20% cement replacement using Class F fly ash permitted, Class C fly ash not permitted unless it also qualifies as a Class F fly ash, mid range water reducing agents permitted, high range water reducing agents not permitted. The slab aggregate gradation requirements in Section 2.03 B shall apply.

END OF SECTION

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SECTION 040100
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 040511 - Masonry Mortaring and Grouting.

B. Section 042000 - Unit Masonry: Brick and Block masonry units.

C. Section 044313 - 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 013000 - 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:

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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 016000 - 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 040511.

2.04 MASONRY MATERIALS

A. Unit Masonry: Section 042000.

B. Cast Stone Masonry: Section 04 7200

C. Stone Veneer: Section 044313.

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.

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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

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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

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SECTION 040511
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 040100 - Maintenance of Masonry: Bedding and pointing mortar for masonry restoration work.

B. Section 042000 - 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 013000 - 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.

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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 C476and 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 014000 - 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: To be selected from manufactures standard colors to match existing, unless specifically scheduled on the drawings.

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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 acordance 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" 5'-0" 12'-0" 24'-0"	3/4" 2" 2 1/2" 3"	1 1/2" x 2" 2" x 3" 2 1/2" x 3" 3" x 3"
Coarse	1'-0" 5'-0" 12'-0" 24'-0"	1 1/2" 2" 2 1/2" 3"	1 1/2" x 3" 2 1/2" x 3" 3" x 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.

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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: To be selected from manufactures standard colors unless specifically scheduled on the drawings.
   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 016000 - Product Requirements.

J. Water: Clean and free from deleterious acids, alkalies, 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.

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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.

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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 042000
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 032000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

B. Section 040100 - Maintenance of Masonry.

C. Section 040511 - Masonry Mortaring and Grouting.

D. Section 055000 - Metal Fabrications: fabricated steel items.

E. Section 061000 - Rough Carpentry: Nailing strips built into masonry.

F. Section 072100 - Thermal Insulation: Insulation for cavity spaces.

G. Section 07 2700 - Air and Water Barriers: Air and water-resistive barriers applied to the exterior face of the backing sheathing or masonry.

H. Section 076200 - Sheet Metal Flashing and Trim: Metal through-wall masonry flashings.

I. Section 078400 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

J. Section 079200 - 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.

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1.05 SUBMITTALS

A. See Section 013000 - 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. Shop drawings shall indicate all required mechanical duct openings and all MEP penetrations through CMU/masonry, including opening size, location, and elevation. Shop drawings that do not show required duct openings and penetrations shall be rejected without review and returned as Revise and Resubmit.

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.

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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. Best Block Construction Materials: www.bestblock.com.
2. Boral Concrete Products: www.boralconcreteproducts.com
3. Oldcastle Architectural, Jewell Concrete Products: www.jewellcp.com.
4. Spectra Development Corporation: www.spectraglaze.com.
5. Texas Building Products, Inc.: www.texasbuildingproducts.com.
6. Trenwyth Industries, Inc.: www.echelonmasonry.com.
7. Substitutions: See Section 016000 - 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.
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.

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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 016000 - Product Requirements.

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
1. Color and texture: Refer to Schedule of Materials and Colors on the drawings.
2. Nominal size: King Size and Modular, locations as indicated in the drawings.
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 040511.

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-BONDwww.wirebond.com/#sle.
5. Substitutions: See Section 016000 - 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 032000; 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 BMill-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).

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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 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.
3. 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 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. HB-213X Adjustable Veneer Anchor as manufactured by Hohmann & Barnard, Inc.
    b. Substitutions: See Section 016000 - Product Requirements.

2.05 FLASHINGS

A. Through Wall Flashing Materials: Products as specified in Sections 07 2700 and 076200.

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 016000 - 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 016000 - 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) CavClear Inc., CavClear Masonry Mat MDCD, www.CavClear.com.
        2) Hohmann & Barnard, Inc; Mortar Trap: www.h-b.com/sle.

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3) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
4) Substitutions: See Section 016000 - Product Requirements.

D. Nailing Strips: Softwood lumber, preservative treated; as specified in Section 061000.

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

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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. Masonry Cold Weather Construction:
1. When ambient air temperature is below 40°F, cold weather procedures shall be implemented.
2. Preparation: Comply with the following requirements prior to conducting masonry work:
a. Masonry units shall not be laid when unit temperature is below 20°F, or when units contain frozen moisture, visible ice, or snow on their surface.
b. Visible ice and snow shall be removed from the top surface of existing foundations and masonry that will receive new construction. These surfaces shall be heated above freezing using methods that do not result in damage.
3. Construction: These requirements apply to work in progress and are based on ambient air temperature. Do not heat water or aggregates used in mortar or grout above 140°F. Comply with the following requirements when the following ambient air temperatures exist:
a. 40°F to 32°F:
1) Heat sand or mixing water to produce mortar temperature between 40°F and 120°F at the time of mixing.
2) Heat grout materials when the temperature of the materials is below 32°F.
b. Below 32°F to 25°F:
1) Heat sand and mixing water to produce mortar temperature between 40°F and 120°F at the time of mixing. Maintain mortar temperature above freezing until used in masonry.
2) Heat grout aggregates and mixing water to produce grout temperature between 70°F and 120°F at the time of mixing. Maintain grout temperature above 70°F at the time of grout placement.
c. Below 25°F to 20°F: Meet all requirements listed under Below 32°F to 25°F, and comply with the following:
1) Heat masonry surfaces under construction to a minimum temperature of 40°F.
2) Wind breaks or enclosures shall be used when wind velocity exceeds 15 mph.
3) Heat masonry to a minimum temperature of 40°F prior to grouting.
d. Below 20°F: Meet all requirements listed under Below 25°F to 20°F, and comply with the following:
1) An enclosure and auxiliary heat shall be provided to maintain air temperature above 32°F within the enclosure.
4. Protection: These requirements shall apply after masonry is placed and are based on anticipated minimum daily temperature for grouted masonry and anticipated mean daily temperature for ungrouted masonry. Protect completed masonry in the following manner:
a. 40°F to 25°F: Protect newly constructed masonry by covering with a weather-resistive membrane for 24 hr after being completed.

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b. Below 25°F to 20°F: Cover newly constructed masonry completely with weather-resistive insulating blankets, or equal protection, for 24 hr after completion of work. Extend the time period to 48 hr for grouted masonry, unless the only cement in the grout is Type III portland cement.
c. Below 20°F: Maintain newly constructed masonry temperature above 32°F for at least 24 hr after being completed by using heated enclosures, electric heating blankets, infrared lamps, or other acceptable methods. Extend the time period to 48 hr for grouted masonry, unless the only cement in the grout is Type III portland cement.

C. Hot weather Construction:
1. Preparation: Prior to conducting masonry work:
a. When the ambient air temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph:
1) Maintain sand piles in a damp, loose condition.
2) Provide necessary conditions and equipment to produce mortar having a temperature below 120°F.
3) Fog spray or wet scratch coats until damp prior to installation of adhered veneer.
b. When the ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph, meet all requirements listed under Section a above, and shade materials and mixing equipment from direct sunlight.
2. Construction: While masonry work is in progress:
a. When the ambient air temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph:
1) Maintain temperature of mortar and grout below 120°F.
2) Flush mixer, mortar transport container, and mortar boards with cool water before they come into contact with mortar ingredients or mortar.
3) Maintain mortar consistency by retempering with cool water.
4) Use mortar within 2 hr of initial mixing.
b. When the ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph, meet all requirements listed under Section a above and use cool mixing water for mortar and grout. Ice is permitted in the mixing water prior to use. Do not permit ice in the mixing water when added to the other mortar or grout materials.
3. Protection: When the mean daily temperature exceeds 100°F or exceeds 90°F with a wind velocity greater than 8 mph, fog spray newly constructed masonry until damp, at least three times a day until the masonry is three days old.

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.

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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 2700 - Air and Water 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 WYTHE 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 2700 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 051200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members and support members.

B. Base plates, shear stud connectors and expansion joint plates.

C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 052100 - Steel Joist Framing.

B. Section 053100 - Steel Decking: Support framing for small openings in deck.

C. Section 055000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2017.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

F. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

I. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2014.

J. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.

K. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2007 (Reapproved 2013).

L. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2021, with Editorial Revision.

M. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).

N. 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.

O. 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.

P. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2015, with Editorial Revision (2018).

Q. 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).

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R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

T. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2014, with Errata (2015).

U. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
2. Connections and the calculations for the design of these connections.
3. Indicate cambers and loads.
4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
5. 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.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Maintain one copy of each document on site.

C. Fabricator: Company specializing in performing the work of this section with minimum three years ofdocumented experience.

D. Erector: Company specializing in performing the work of this section with minimum three years of documented experience.

E. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Texas.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Plates: ASTM A572/A572M, Grade 50.

B. Steel Angles: ASTM A572/A572M, Grade 50.

C. Steel W Shapes and Tees: ASTM A992/A992M.

D. Steel C and MC Channels: ASTM A992/A992M.

E. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade C.

F. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.

G. Steel Bars: ASTM A108Grade 50.

H. Steel Plate: ASTM A514/A514M.

I. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.

J. Pipe: ASTM A53/A53M, Grade B, Finish black.

K. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

L. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

M. Headed Anchor Rods: ASTM F 1554, Grade 55, plain as indicated on the drawings.

N. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

O. Sliding Bearing Plates: Teflon coated.

P. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107/C 1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days.

Q. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

R. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Space shear stud connectors at as indicated on the drawings.

C. Continuously seal joined members by intermittent welds and plastic filler. Grind exposed welds smooth.

D. Fabricate connections for bolt, nut, and washer connectors.

E. Develop required camber for members.

2.03 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 3, Power Tool Cleaning.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.04 SOURCE QUALITY CONTROL

A. If any steel fabrication occurs off-site (at a fabrication shop) that is not an AISC certified fabrication shop, the Steel Fabricator shall pay for the SITA to perform the special inspections or testing required by Section 01 4533 for all such off-site steel fabrication. Source quality control testing is not required for any steel provided by an AISC certified steel fabrication shop.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components and shear studs indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

E. Do not field cut or alter structural members without approval of Architect.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

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.

END OF SECTION

SECTION 052100
STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Open web steel joistsand shear stud connectors, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for floor and roof openings greater than 18 inches.

1.02 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.

B. Section 051200 - Structural Steel Framing: Superstructure framing.

C. Section 053100 - Steel Decking: Support framing for openings less than 18 inches in decking.

D. Section 055000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014 (Editorial 2017).

E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

F. SJI (SPEC) - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; 2011.

G. SJI 100 - Catalog of Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders; 2011.

H. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

J. SSPC-SP 2 - Hand Tool Cleaning; 2024.

K. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

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. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

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1.05 QUALITY ASSURANCE

A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Texas.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

C. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum three yearsdocumented experience.

D. Erector Qualifications: Company specializing in performing the work of this section with minimum three yearsdocumented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Joists:
   1. Canam Group Inc: www.canam-steeljoists.ws
   2. Nucor-Vulcraft Group: www.vulcraft.com/#sle.
   3. New Mellennium Building Systems, LLC: www.newmill.com
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Open Web Joists: SJI Type K Joists:
   1. Provide bottom and top chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: As shown on the drawings.
   3. Minimum End Bearing on Concrete or Masonry Supports: As shown on drawings.
   4. Finish: Shop primed.

B. Anchor Bolts, Nuts and Washers: ASTM A307 hot-dip galvanized per ASTM A153/A153M Class C.

C. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

D. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A 36/A 36M.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Frame special sized openings in joist web framing as detailed.

2.04 FINISH

A. Shop prime joists as specified.
   1. Do not prime surfaces that will be fireproofed, field welded, or in contact with concrete.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

2.05 SOURCE QUALITY CONTROL

A. For joist fabrication that occurs at a joist fabrication shop that is not an SJI certified joist fabrication shop, the Joist Fabricator shall pay for the SITA to perform the special inspections or testing required by Section 01 4533 for all such off-site steel fabrication. Source quality control testing is not required for any joists provided by an SJI certified joist fabrication shop.

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PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Position and field weld joist chord extensions and wall attachments as detailed.

F. Install supplementary framing for floor and roof openings greater than 18 inches.

G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

H. Do not field cut or alter structural members without approval of joist manufacturer.

I. After erection, prime welds, damaged shop primer, and surfaces not shop primed , except surfaces specified not to be primed.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Alignment: 1/4 inch.

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.

END OF SECTION

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SECTION 053100
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof deck.

B. Supplementary framing for openings up to and including 18 inches.

C. Bearing plates and angles.

D. Stud shear connectors.

E. Acoustical insulation in roof deck flutes.

1.02 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete: Concrete topping over metal deck.

C. Section 051200 - Structural Steel Framing: Support framing for openings larger than 18 inches and shear stud connectors.

D. Section 055000 - Metal Fabrications: Steel angle concrete stops at deck edges.

E. Section 09 9000 - Painting and Coating

2.01 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2013.

C. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2020.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. 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.

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

I. FM (AG) - FM Approval Guide; current edition.

J. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems; 2022.

K. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; 2016.

L. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

N. UL (FRD) - Fire Resistance Directory; Current Edition.

2.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittals procedures.

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B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

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. Certificates: Certify that products furnished meet or exceed specified requirements.

F. Submit manufacturer's installation instructions.

G. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

2.03 QUALITY ASSURANCE

A. Design deck layout, spans, fastening, and joints 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 work of this Section with minimum three years of experience.

2.04 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

3.01 MANUFACTURERS

A. Steel Deck:
1. Canam Steel Corporation: www.canam-steeljoists.ws.
2. CSI - Metal Dek Group: www.metaldek.com
3. Nucor-Vulcraft Group: www.vulcraft.com.
4. New Mellennium Building Systems, LLC: www.newmill.com
5. Substitutions: See Section 016000 - Product Requirements.

3.02 STEEL DECK

A. Roof Deck:
1. Type "B": Non-composite type, fluted steel sheet
2. Steel Sheet:
   a. Ungalvanized Steel Sheet: ASTM A1008/1008M, Designation SS, Grade 33, Type 1. (typical) except where metal roof deck is to receive cementitious fireproofing.
   b. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating where metal roof deck is to receive cementitious fireproofing.
3. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate. See Section 09 9000 - 'Painting and Coating' for any additional requirements.
4. Structural Properties:
   a. Span Design: Triple.
5. Minimum Metal Thickness, Excluding Finish: 20 gage (unless noted otherwise on the Structural Drawings).
6. Nominal Height:
   a. Type "B": 1-1/2"

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7. Profile:
   a. Type "B": Fluted; SDI WR
8. Formed Sheet Width:
   a. Type "B": 36 inch
9. Deck Attachment (Unless noted otherwise on the Structural Drawings):
   a. Side Joints: Lapped, mechanically fastened. (5) #10 TEK screws at each deck span
   b. End Joints/Fasteners and Intermediate Support Fasteners: Lapped, welded
      1) Type "B": 5/8" puddle welds on a 36/7 pattern
   c. Side Support Fasteners: Welds matching End joint fasteners at 6" on center

3.03 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steelunfinished.

B. Stud Shear Connectors: Made from ASTM A 108 Grade 1015 bars.

C. Welding Materials: AWS D1.1/D1.1M.

D. Fasteners: Galvanized hardened steel, self tapping.

E. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.
   1. Design Requirements: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
   2. Material: Steel; ASTM A510/A510M.
      a. Hardness: Rockwell C 54.5, minimum.
      b. Tensile Strength: 285 kips per square inch, minimum.
      c. Shear Strength: 175 kips per square inch, minimum.
      d. Washers:
         1) Steel Bar Joist Framing Applications: 0.472 inch diameter, minimum.
         2) Exposed Roof Deck Applications: 0.591 inch diameter, minimum.
      e. Corrosion Resistance:
         1) Steel Bar Joist Framing Applications: ASTM B633, SC1, Type III zinc electroplate..
         2) Exposed Roof Deck Applications: Provide manufacturer's standard stainless steel sealing caps with bonded neoprene washer over each fastener.

F. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.
   1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
   2. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B633, SC1, Type III zinc electroplate.
   3. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.

G. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

I. Flute Closures: Closed cell foam rubber, 1 inch thick minimum; profiled to fit tight to the deck with continuous sealant around entire air dam flute closure profile for continuous seal where deck transitions from interior to exterior conditions. Where deck extends past exterior walls: air dam flute closure assembly shall be provided to prohibit air movement. Air dam assembly shall maintain less than 0.02 cfm/ft2 at 1.57 lb/ft2 of allowable air infiltration.

J. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck at interior conditions only.

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3.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 20 gage, 0.0359 inch thick sheet steel; of profile and size as indicated; finished same as deck.

B. Cant Strips: Formed sheet steel, 20 gage, 0.0359 inch minimum thickness, 45 degree slope, 3-1/2 inch nominal width and height, flange for attachment.

C. Roof Sump Pans: Formed sheet steel, 14 gage, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

D. Floor Drain Pans: Formed sheet steel, 14 gage, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

4.02 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.

4.03 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual. Align and level.

B. On concrete surfaces provide minimum 4 inch bearing.

C. On steel supports provide minimum 1-1/2 inch bearing.

D. Fasten deck to steel support members at ends and intermediate supports as indicated in section 2.02, parallel with the deck flute and at every other transverse flute using methods indicated on drawings.
   1. Welding: Use fusion welds through weld washers.
   2. Place and secure special deep fluted sections for integral concrete bridging.

E. At mechanically fastened male/female side laps fasten as indicated in section 2.02.

F. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

G. At welded male/female side laps weld at 18 inches on center maximum.

H. Weld deck in accordance with AWS D1.3/D1.3M.

I. At deck openings greater than 8 inches, provide support per Structural Drawings. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.

J. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck, fusion weld 12 inches on center maximum, unless alternative detail is provided in the Structural Drawings.

K. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

L. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

M. Close openings above walls and partitions parallel and perpendicular to deck flutes with double row of foam cell closures. At exterior walls: provide air dam flute closure assembly to prohibit air movement. Air dam assembly shall maintain less than 0.02 cfm/ft2 at 1.57 lb/ft2 of allowable air infiltration.

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N. Place metal cant strips in position and mechanically attach.

O. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

P. Position floor drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

Q. Weld stud shear connectors through steel deck to structural members below.

R. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION

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SECTION 054000
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 053100 - Steel Decking.

C. Section 061000 - 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 013000 - 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:

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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.millsteelframing.com
5. Telling Industries, LLC: www.buildstrong.com.
6. Substitutions: See Section 016000 - Product Requirements.

B. Framing Connectors and Accessories:
1. Same manufacturer as metal framing.
2. Simpson Strong Tie: www.strongtie.com.
3. Substitutions: See Section 016000 - 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.

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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 lateral 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.

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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.

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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

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SECTION 055000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel items.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 042000 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 051200 - Structural Steel Framing: Structural steel column anchor bolts.

D. Section 052100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.

E. Section 053100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.

F. Section 055133 - Metal Ladders.

G. 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; 2024.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

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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 C 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.

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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. Downspout Boots shall be fabricated from cast iron steel and field painted to match downspouts. See drawings for details.

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.

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.

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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 or 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.

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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, abrasionsand 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.

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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 055133
METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop-fabricated metal ladders.

B. Ladder safety systems.

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. 29 CFR 1910.28 - Duty to have Fall Protection and Falling Object Protection; Current Edition.

C. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices; Current Edition.

D. 29 CFR 1910.140 - Personal fall protection systems; Current Edition.

E. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

F. ANSI/ASSP Z359.11 - Safety Requirements for Full Body Harnesses; 2014.

G. ANSI/ASSP Z359.12 - Connecting Components for Personal Fall Arrest Systems; 2009.

H. ANSI/ASSP Z359.16 - Safety Requirements for Climbing Ladder Fall Arrest Systems; 2016.

I. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

K. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

L. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

M. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

N. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021.

O. 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).

P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

S. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

T. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

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B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.

C. 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.

D. Certificate: Provide documentation that ladder safety system products of this section meet or exceed cited 29 CFR 1910.28, 29 CFR 1910.29, ANSI/ASSP Z359.16, and ANSI A14.3 requirements.

E. 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; prime paint finish.

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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 LADDER SAFETY SYSTEMS

A. Ladder Safety System: Comply with 29 CFR 1910.28 (b)(9)(i-iv), 29 CFR 1910.29, 29 CFR 1926.1053, and Section 7 of ANSI A14.3; ladder safety system allows the worker to climb up and down using both hands; does not require the employee continuously, hold, push, or pull any part of the system while climbing.
   1. Install on new fixed ladders over 24 feet in height.
   2. Anchorage: Fixed ladder meeting requirements of 29 CFR 1910.23.
   3. Flexible Carrier: Fixed 3/8 inch diameter galvanized steel wire rope lifeline with shock absorber and top, bottom and intermediate supports.
   4. Rigid Carrier: Fixed galvanized steel U-shaped slotted track with top, bottom and intermediate supports.
   5. Fall Arrester: Stainless steel and aluminum manual pass-through carrier sleeve fall arrester; compatible with carrier.

B. Personal Fall Arrest System Components; 29 CFR 1910.140:
   1. Body Support: Full body harness meeting requirements of ANSI/ASSP Z359.11; equipped with front or hip D-rings for attachment to climbing ladder fall arrest system.
   2. Connecting Means: Connecting hardware, such as a locking carabiner, meeting requirements of ANSI/ASSP Z359.12; compatible with fall arrester and body support harness.

2.05 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.

2.06 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.

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B. Confirm that the ladder structure to which the ladder safety system is installed is capable of withstanding the loads applied by the system in the event of a fall.

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. Wall mounted laddeer brackets are to be attached to the back-up wall or other building structurak member with a galvanized steel tube-profile assembly that can be properly integrated into the air barrier system. With bracket in place, the cladding assembly can be installed with the ladder to follow. Metal ladders shall not penetrate the roofing system and terminateabove the roof surface with adequate clearance to properly maintain or replace the roofing system as needed.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

C. Install ladder safety system in accordance with manufacturer's instructions.

D. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

E. Field weld components as indicated.

F. Perform field welding in accordance with AWS D1.1/D1.1M.

G. Obtain approval prior to site cutting or making adjustments not scheduled.

H. 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

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SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-structural dimension lumber framing.
B. Structural Composite Lumber
C. Sheathing.
D. Roofing nailers.
E. Roofing cant strips.
F. Preservative treated wood materials.
G. Fire retardant treated wood materials.
H. Miscellaneous framing and sheathing.
I. Concealed wood blocking, nailers, and supports.
J. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
B. Section 055000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.
C. Section 077200 - 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 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, application instructions, and vendor.
C. Structural Composite Lumber: Submit manufacturer's published structural data including span tables, marked to indicate which sizes and grades are being used; if structural composite lumber is being substituted for dimension lumber or timbers, submit grading agency structural tables marked for comparison.

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D. 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.

E. 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 STRUCTURAL COMPOSITE LUMBER

A. System Description
   1. Design Requirements: Design gate system to withstand Miami/Dade County 110 MPH steady wind and 130 MPH gusting wind tests.

B. Warranties
   1. Furnish manufacturer's 10-year warranty providing coverage against checking, splitting, splintering, rotting, structural damage from termites and fungal decay of composite wood.

C. Materials

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1. Composite Wood:
   a. Reclaimed wood and plastic with integral coloring; free from toxic chemicals and preservatives.

D. Components
   1. Gate System: as detailed on the drawings.
      a. Components:
         1) Pickets
         2) Top and bottom rails.
         3) Bottom rail inserts.
      b. Surface texture: Smooth.
      c. Color: as selected by Architect.

E. Accessories
   1. Fasteners: Galvanized or corrosion-resistant coated steel.
   2. Provide stainless steel where used at fire retardant or pressure treated wood.

F. Manufacturers:
   1. Trex Company: www.trex.com
   2. iLevel by Weyerhaeuser: www.ilevel.com.
   3. Boise Cascade: www.bc.com.
   4. Georgia-Pacific Corp.: www.gp.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.04 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.

2.05 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.

2.06 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.

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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. Air and Water Barrier as specified in Section 07 2700.

2.07 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: AWPA 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: AWPA 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. Treat lumber in contact with roofing, flashing, or waterproofing.

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d. 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: AWPA 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 masonry or concrete.
d. Treat lumber in other locations as indicated.
2. Preservative Pressure Treatment of Plywood Above Grade: AWPA 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 masonry or concrete.
c. Treat plywood in other locations as indicated.
3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA 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.
4. Preservative Pressure Treated plywood or lumber in contact with roofing, flashing or waterproofing is not permitted

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.

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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 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.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. 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 fire-retardant treated 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 fire-retardant treated 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. Fire treat surfaces exposed by cutting as recommended by preservative manufacturer.
4. Fasten fire-retardant treated 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.

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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

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SECTION 062000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 081416 - Flush Wood Doors.

C. Section 099000 - 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 013000 - 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.

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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

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SECTION 070150.19
PREPARATION FOR ROOF RE-COVERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Repair and replacement of existing roofing assemblies for alterations.

B. Temporary roofing protection.

1.02 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).

B. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing; 2016a (Reapproved 2023).

A. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2015a (Reapproved 2021).

B. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004 (Reapproved 2020).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

B. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Attendees:
      a. Architect.
      b. Contractor.
      c. Owner.
      d. Installer.
      e. Roofing system manufacturer's field representative.
   2. Meeting Agenda: Provide agenda to participants prior to meeting in preparation for discussions on the following:
      a. Removal and installation schedule.
      b. Necessary preparatory work.
      c. Protection before, during, and after roofing system installation.
      d. Removal of existing roofing system.
      e. Installation of new roofing system.
      f. Temporary roofing and daily terminations.
      g. Transitions and connection to and with other work.

C. Schedule work to coincide with commencement of installation of new roofing system.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit for each type of material to be used as temporary coverings

C. Shop Drawings: Indicate size, configuration, and installation details.

1.05 QUALITY ASSURANCE

A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of experience.
   1. Comply with EPA notification regulations prior to start of roofing removal work.
   2. Comply with removal and disposal regulations of local authorities having jurisdiction (AHJ).

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B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of experience and approved by manufacturer.
   1. Approved by existing roofing system warrantor to work on existing warranted roof system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.07 FIELD CONDITIONS

A. Existing Roofing System: Built-up asphalt and modified bitumen roofing.

B. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.

C. Maintain continuous temporary protection prior to and during installation of new roofing system.

D. Provide notice at least three days before starting activities that will affect normal building operations.

E. Verify that occupants have been evacuated from building areas when work on structurally impaired roof decking is scheduled to begin.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Materials: Provide necessary materials in accordance with requirements of existing roofing system.

B. Temporary Roofing Protection Materials:
   1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

C. Roofing Recover Materials:
   1. Contractor's responsibility to select appropriate materials for roofing re-cover as determined necessary for this work.

2.02 ACCESSORIES

A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.

B. Base Sheet: Non-perforated, asphalt-coated glass fiber base sheet, Type II in accordance with ASTM D4601/D4601M.

C. Glass Fiber Felt: Asphalt-impregnated, glass fiber felt, Type IV in accordance with ASTM D2178/D2178M.

D. Asphalt Primer: Apply to concrete decking in preparation for temporary roofing, Type II in accordance with ASTM D41/D41M.

E. Roofing Asphalt: Type III or Type IV, in accordance with ASTM D312/D312M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.02 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

A. Remove only existing roofing materials that can be replaced with new materials the same day.

B. Vacuum loose roofing gravel from membrane surface without causing serious damage to membrane felts.

C. Remove damaged portions of roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets and insulation vents.

D. Cut and lay flat any membrane blisters.

E. Remove damaged insulation and fasteners, cant strips, and blocking.

F. Repair existing metal deck surface to provide smooth working surface for new roof system.

3.04 INSTALLATION

A. Coordinate scope of this work with requirements for installation of new roofing system to match existing roof assembly.

3.05 PROTECTION

A. Provide protection of existing roofing system that is not having work performed on it.

B. Provide temporary protective sheeting over uncovered deck surfaces.

C. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.

D. Provide for surface drainage from sheeting to existing drainage facilities.

E. Do not permit traffic over unprotected or repaired deck surface.

F. Install 1 inch polyisocyanurate insulation and recover board over existing membrane.

END OF SECTION

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SECTION 072100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at masonry cavity wall construction and exterior wall behind masonry veneer 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 078400 - 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 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations. For polyisocyanurate board insulation in wall cavities, provide manufacturer letter indicating the moisture resistance and dimensionally stability of this product through a 50-year min. life cycle.

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.

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D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

E. Insulation Schedule: Provide schedule that outline conditions which require each insulation type, thickness, etc.

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 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. Basis of Design: 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. Holcim Elevates: www.holcimelevate.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 016000 - 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.

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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 016000 - 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 016000 - 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 016000 - 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:

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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 016000 - Product Requirements.

2.05 ACCESSORIES

A. Air Barrier Sheet or Air Barrier Coating: See Section 07 2500.

B. Provide insulation retainer membrane into this item for maintaining batt insulation in place within the expansion joint assemblies.

C. 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.

D. Insulation Pins: Insulation manufacturer's standard stainless steel pins with perforated plates, intended for installation in adhesive.

E. 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 INTENT

A. The thermal barrier is to be continuous throughout the building including locations where insulation type changes and where the existing and new building interface without excessive gaps or discontinuities.

3.02 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.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Install board 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.

3.04 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.

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3.05 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. Ceilling 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 072500.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

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SECTION 072200
ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Roof and Deck Insulation.

1.02 RELATED WORK

A. Section 06 1000 - Rough Carpentry

B. Section 07 5100 - Built-Up Bituminous Roofing

C. Section 07 5419 - Polyvinyl-Chloride (PVC) Membrane Roofing

D. Section 07 6200 - Sheet Metal Flashing and Trim

1.03 SYSTEM DESCRIPTION

A. Install rigid board insulation and coverboard as required to achieve a complete and proper substrate for the roof membrane system and associated crickets, saddles, and taper to provide complete drainage of stormwater. Refer to Part 2 and Drawings for insulation thicknesses required. Roofing insulation is intended to be included within a single source warranty by the primary roofing manufacturer.

1.04 SUBMITTALS

A. Submit manufacturer's installation instructions, samples and product data, in accordance with the provisions of Division 1.

B. Submit fastening and adhesive patterns for field, perimeter, and corner areas to sufficiently comply with wind loads calculated in accordance with ASCE 7, as referenced by applicable Codes.

C. Submit roof plan indicating proposed dimensions of perimeter and corner zones, complying with minimum requirements specified in the Drawings.

D. Submit tapered insulation layout plans.

E. Submit manufacturer's certificate, in accordance with the provisions of Section 013300, that products meet or exceed specified requirements.

F. Submit certification from roof membrane manufacturer that board insulation materials are acceptable for use with roof membrane materials.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable local building codes for roof assembly requirements.

1.06 QUALITY ASSURANCE

A. Comply with PIMA and NRCA standards and requirements.

B. Materials shall comply with the requirements to meet UL Class A Ratings (UL 790 and UL 1256 Standard) and FM Global Class 1 (FM 4450 and FM 4470) requirements.

C. Contractor shall provide in-place mock-ups to illustrate insulation offsets and staggers in accordance with the requirements in this Section.

D. Work shall not commence prior to the Pre-Roofing Conference.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver and store products in accordance with the provisions of Division 1.

B. Any material becoming wet or damaged, including water stained facers will be rejected and shall be removed from the jobsite immediately and replaced at Contractor’s expense. Any insulation found to be improperly stored at the jobsite shall be considered wet at the discretion of the Architect and removed from the jobsite.

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C. Materials Stored on Roof Levels for Immediate Use Only:
   1. Comply with maximum roof live loads specified by the Structural Engineer.
   2. Distribute to prevent concentrated loads that would impose excessive strain on deck or structural members.
   3. Positively secure to prevent displacement by wind.
   4. Tarp for protection from exposure as noted above.
   5. Material storage on roof levels overnight is not allowed.

1.08 SEQUENCING AND SCHEDULING

A. Coordinate work under provisions of Division 1.

B. Coordinate the work of installing roof membrane and flashing as the work of this Section proceeds.

C. Plan roof layout with respect to roof deck slope to prevent rainwater drainage into completed roofing. All roof drains and/or scuppers shall be installed prior to beginning with installation. Contractor shall coordinate location and heights of drains/scuppers to ensure ponding does not occur after roof installation. Improper coordination for drainage components resulting in ponding or shaved rigid insulation will require correction at the Contractor's expense.

D. Do not install more insulation than can be covered with the complete roof system in the same day.

E. Do not install roofing until all wood blocking, roof curbs, and penetrations have been installed.

F. Do not install materials in fog and/or inclement weather or when rain is predicted (30% or more possibility) or when ambient temperature is below 40 F. The Contractor shall suspend work if in their opinion, wind speed will impede the proper installation of the roofing work or cause a danger to personnel or the property.

PART 2 - PRODUCTS

2.01 VAPOR BARRIER

A. Roofing vapor barrier is intended to be included within a single source warranty by the primary roofing manufacturer.

B. Acceptable Vapor Barriers:
   1. Smooth SBS modified bitumen sheet vapor barrier set in cold adhesive,
   2. Torch applied SBS modified bitumen sheet vapor barrier, ASTM D 4601, Type II, and ASTM D 1970.
   3. Built up felts set in hot asphalt, minimum four (4) plies ASTM D 2178 Type VI asphalt-impregnated, glass-fiber felt, with a glaze coat of asphalt at the top surface.

2.02 INSULATION MATERIALS

A. Flat Stock Polyisocyanurate Insulation, ASTM C1289, Type II, Class 2, Grade 2 (20 psi) closed cell foam core bonded to coated fiberglass facers, 4'x4' maximum board dimension,
   1. Maximum board thickness: 2.6".
   2. System Thickness (metal and membrane roofs over conditioned space): Two (2) layers 2.5" or 2.6" thickness insulation, total thickness 5" minimum.

B. Tapered Polyisocyanurate Insulation, ASTM C1289, Type II, Class 2, Grade 2 (20 psi) closed cell foam core bonded to coated fiberglass facers, slope as indicated in the Drawings,
   1. Maximum board thickness: 2.6", except in locations where at least 3 layers of insulation are present.
   2. System thickness (membrane roofs over conditioned space): Total average thickness 5" minimum, with average calculated based on a maximum variation of 1 inch.

C. Tapered Edge Strips expanded perlite, ASTM C 728, Type 1.

D. Cover Board: 4’x4’ board dimension, 5/8” thickness, approved for use in Factory Mutual Very Severe Hail (VSH) approved assemblies.
   1. Dexcell FA VSH Glass Mat Roof Board
   2. Densdeck StormX Prime
   3. USG Gypsum Fiber Roof Board
   4. Pre-proposal approved equivalent.

2.03 ACCESSORIES

A. General: Provide fasteners approved by insulation manufacturer, meeting wind uplift requirements as specified.

B. Metal Decks: No. 12 hex-head fastener with coating which exceeds F.M. Specification No. 4470
   1. Induction welding type metal plates, approved by roof membrane manufacturer.

C. Insulation Adhesive: manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Modified asphaltic, asbestos-free, cold-applied adhesive.
   2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
   3. Full-spread spray-applied, low-rise, two-component urethane adhesive.

D. Pre-fabricated tapered roof drain sump insulation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean deck and ensure deck is dry prior to the application of new roof assembly.

B. Wet, water stained, warped, discolored, or physically damaged insulation and/or insulation facers will be rejected and must be removed from the project site.

C. Verify that:
   1. Roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set and comply with specified minimum flashing height requirements.
   2. Wood nailing strips at perimeter edges and parapet walls are in place and are fastened in accordance with applicable codes.
   3. Deck conditions are free and clear of dirt, rust, moisture, debris, and surface conditions are in accordance with manufacturer required guidelines for adhesion.
   4. Under deck conditions are clear for fastener installation. Contractor is responsible for field verifying the roof deck underside to ensure no equipment or MEP lines will be damaged from new fasteners. While excessive length roofing fasteners should not be used, the MEP subcontractors also should not be attaching anchors, straps, or fasteners to the roof deck or equipment, piping or other service lines in close proximity (within 3") of the roof deck. All damaged components will be the responsibility of the Contractor.
   5. Insulation strips are installed according to acoustical roof deck manufacturer’s written instructions.

D. Installation of materials means acceptance of conditions of substrate.

3.02 VAPOR BARRIER INSTALLATION

A. Prime cleaned, dry deck in accordance with manufacturer instructions, allow primer to fully flash off, install vapor barrier to primed substrate immediately after primer is suitable for receiving membrane. Do not allow primer to sit overnight.

B. Adhere vapor barrier to ensure full adhesion to substrate and adequate bleedout/bond. Do not overheat or apply excessive adhesive.

C. Limit foot traffic over vapor barrier in accordance with manufacturer recommendations. Inspect vapor barrier immediately prior to insulation adhesion and repair damage in accordance with manufacturer requirements. Clean surface of vapor barrier to remove debris just prior to installation of insulation boards.

3.03 INSULATION INSTALLATION

A. Insulation layers are to be installed with an offset of 6" minimum to minimize the effect of thermal bridging.

B. Only install materials that can be temporarily sealed at the end of the workday. All open roof areas are to be temporarily sealed at the end of each workday or when inclement weather is expected. Any installed roof materials that become wet must be removed and replaced prior to continuing roofing

C. Verify and document in Daily Report that the existing deck/substrate is functional; insulation board is free from moisture and suitable as substrate for roof membrane.

D. Attachment Schedule: Comply with approved fastening patterns and zone widths.
   1. Metal Decks with Membrane Roofing:
      a. Mechanically fasten first layer of insulation to achieve uplift pressures indicated in Drawings in field, perimeter, and corners, and per approved fastening patterns based on pull out testing performed in accordance with Section 07 01 50. Ensure proper fastener engagement in substrate to provide full pullout resistance.
      b. Install subsequent layers of insulation and coverboard in adhesive in accordance with approved ribbon spacing patterns for field, perimeter, and corner areas and as specified below.
   2. Metal Decks with Metal Roofing:
      a. Mechanically fasten all layers of insulation to substrate, with boards laid in staggered pattern.
      b. Provide a minimum 8 fasteners per 4’x8’ board, with additional fasteners as required to ensure a smooth substrate for installation of underlayment materials and panel clips.

E. Mechanical Fastener Installation, General:
   1. Mechanically fasten first layer boards with approved fasteners and plates.
   2. Ensure that fasteners penetrate top flange of deck ¾-inch, do not penetrate bottom flange of deck. Reinstall fasteners that do not engage top flute of deck.
   3. Provide fasteners in location per the approved fastening pattern and layout provided by the manufacturer. Provide required edge distance between fasteners and edge of boards.

F. Adhesive Application, General:
   1. Install insulation and coverboard layers in low-rise foam adhesive in accordance with approved ribbon spacing patterns and shop drawings for field, perimeter, and corner areas. Install adhesive in “picture frame” pattern in addition to ribbons required to achieve Code required resistance to wind uplift in field, perimeter, and corner zones. “Picture frame” pattern shall consist of a single bead of adhesive applied within 2” of board perimeter.
   2. Do not allow the adhesive application to precede the board placement by more than three board lengths.
   3. Allow low-rise foam adhesive to rise between ¾” to 1” prior to placement of boards, or as required by the manufacturer.
   4. Firmly press each insulation board into adhesive by “walking-in” each board immediately after placement. Provide a minimum of five (5) weighted five (5) gallon buckets per board at corners and center of each board. Boards not properly adhered will require to be removed and replaced.

5. Stagger end joints in adjacent boards. Stagger successive layers in both vertical and horizontal directions. Minimum horizontal stagger is 2-feet; minimum vertical stagger is 12-inches.
6. Butt edges for snug contact. Repair voids greater than ¼" wide by filling with like material.
7. Tapered Insulation Sumps and Crickets:
   a. Curbs: Install upslope crickets at all curbs wider than 12 inches.
   b. Drains: Install a minimum 4'-0" by 4'-0" tapered insulation sump at all primary roof drains. Install a minimum 4'-0" by 2'-0" tapered insulation sump at all primary scuppers.
   c. Gutters: Install a minimum 1'-0" wide tapered edge to increase slope at membrane roof gutter edges.

G. Failure to install the roof insulation fasteners and/or low-rise foam adhesive as described in these specifications and the approved manufacturer's assembly letter will be considered defective workmanship and application of the roof system by the Contractor. Contractor shall remove and replace all roof system materials with non-compliant attachment at no cost to the Owner.

END OF SECTION

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SECTION 072700
AIR AND WATER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air and Water Barriers.

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 veneer wall construction.

1.02 RELATED REQUIREMENTS

A. Section 01 1400 - Quality Requirements: Coordinatin with Independent Testing and Inspections Agency.

B. Section 01 4339 - Mock-Up Wall Construction: Exterior wall mock-ups.

C. Section 03 1119 - Insulating Concrete Forming

D. Section 04 2000 - Unit Masonry: Coordination of through wall flashing and masonry ties.

E. Division 07 Membrane Roofing Systems: Requirements for coordination with sequencing of membrane roofing; requirements to seal roof membrane to wall air and water barrier.

F. Section 076200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with air barriers.

G. Section 07 9200 - Joint Sealants.

H. Section 07 9500 - Expansion Joints.

I. Section 092116 - Gypsum Board Assemblies: Exterior Sheathing.

1.03 DEFINITIONS

A. Air and Water Barrier: One or more chemically compatible materials joined together in a continuous manner to restrict or prevent the passage of air and liquid water through the building thermal envelope and its assemblies while remaining vapor permeable to the permeance amounts as specified, with sealed seams and sealed joints to adjacent surfaces.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2014.

B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2010).

D. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2017.

E. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2017.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

H. ASTM E1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems; 2017.

I. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

J. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies; 2018.

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K. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; 2016.

L. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; 2015.

M. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2019.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

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 and water barrier and other wall components (penetrations, etc.) in order to maintain continuity of the air and water 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 013000 - 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 and Water Barrier membrane manufacturer shall provide an ICC-ES Evaluation Report confirming compliance with ICC-ES AC38 Acceptance Criteria for Water-Resistive Barriers and ICC-ES AC212 Acceptance Criteria for Water-Resistive Coatings used as Water-Resistive Barriers over:
   1. Glass-mat faced gypsum wall systems.
   2. Masonry wall systems.
   3. Expanded polystyrene (ICF) wall systems.

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.

H. Manufacturer's qualification statement.

I. Installer's qualification statement.

1.07 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Evaluated Air Barrier Assemblies; 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 the work of this section with minimum three years 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. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air and water barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

D. 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-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Mockups: Before beginning installation of air and water barrier, provide air and water 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 and water barrier before external insulation and cladding is installed.
   2. If Architect determines mockups do not comply with project requirements, reconstruct mockups and apply air and water 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.

C. Through Wall Flashing:
   1. Contractor shall provide an in-place mockup for review by Architect and Consultant of complete through wall flashing system, including metal drip edges, incorporating end dams at a typical termination of flashing.
   2. 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.

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3. 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.

D. Install air and water barrier materials in mock-up specified in Section 04 2000.

E. Provide air/water leakage testing for air barrier materials and flashings located at mockup window systems per Division 8 Sections and 01 4000 - Quality Requirements.

1.10 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

1.11 WARRANTY

A. See Section 017800 - 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 AIR AND WATER BARRIER ASSEMBLIES

A. General: Air and water 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 and water 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 and water 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 and water barrier shall be compatible with the following wall systems:
1. Glass-mat faced gypsum wall systems.
2. Masonry wall systems.
3. Expanded polystyrene (ICF) wall systems.

C. The air and water barrier assembly, including but not limited to, fluid applied air and water 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. Use regular, high temperature or low temperature formulation depending on site conditions, within temperature ranges specified by the manufacturer and/or the Architect. Subject to compliance and compatibility with other requirements herein.

2.02 AIR AND WATER BARRIER MATERIALS (AIR AND WATER IMPERMEABLE AND WATER VAPOR PERMEABLE)

A. Air and Water Barrier, Fully Self-Adhered, Vapor Permeable, Sheet Membrane: For use at Expanded Polystyrene (ICF) Wall Systems behind thermally thin veneer exterior caldding such as metal wall panels, or ACM/MCM panels, or other rainscreen cladding systems as specified for compliance with NFPA 285.
1. Material: Coated spun-bond polyethulene fabric with continuous vapor permeable adhesive sheet membrane
a. Dry tensile strength and elongation to ASTM D828: 37.7 lbf (6.6 n), machine direction; 21.3 lbf (390 n), cross-machine direction.

b. Dry breaking strength and elongation to ASTM D5034: 119 lbf (529 n), machine direction; 96 lbf (427 n), cross-machine direction.
c. Physical dimensions: 19 mil (0.48 mm) thick
d. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
e. Water Vapor Permeance: 26 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.
f. Water resistance: water penetration resistance of 550cm or less, when tested in accordance with AATCC Test Method 127 test method for water resistance hydrostatic pressure.
g. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 365 of weather exposure.
    1) Where exterior cladding with open joints are used, provide UV stable air and water barrier; approved by manufacturer for permanent expose to sunlight
h. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 75 or less, Class A when tested in accordance with ASTM E84 or UL 723, with test specimen preperation in accordance with ASTM E2404.
i. Measured heat release rate by cone calorimeter: peak heat release rate of less than 150 kw/sq m, a total heat release of less than 20 mj/sq m, and an effective heat of combustion of less than 18 mj/kg when tested on specimens at the thickness intended for use, all in accordance with ASTM E1354, in the horizontal orientation, and at an incident radiant heat flux of 50 kw/sq m.
j. Wall Assembly Burn Test: Where required by code, Air and Water Barrier, as a component of a wall assembly, shall have passed a NFPA 285 complete wall fire test.
k. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
l. Pull Adhesion: Passing at 16 psi min, when tested in accordance with ASTM D4541.
m. Crack Bridging: Pass, when tested in accordance with ICC-ES AC212 or ASTM C1305
n. Sealants, Tapes and Accessories: As recommended by Air and Water Barrier manufacturer.
o. Products:
    1) VaproShield, LLC; RevealShield SA - Self-Adhered: www.vaproshield.com/#sle.
    2) VaproShield, LLC; PanelShield SA - Self-Adhered: www.vaproshield.com/#sle.
    3) Substitutions: See Section 016000 - Product Requirements.

B. Air and Water Barrier, Fluid Applied, Vapor permeable, elastomeric barrier.
1. Air and Water Barrier Membrane:
a. Material: One-component, water-based, elastomeric emulsion membrane.
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 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
d. Water Vapor Permeance: 11 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F.
e. Water Resistance: Water penetration resistance of 210cm or less, when tested in accordance with AATCC Test Method 127 test method for water resistance hydrostatic pressure.
f. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 180 days of weather exposure.
    1) Where exterior cladding with open joints are used, provide UV stable air and water barrier; approved by manufacturer for permanent expose to sunlight.

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g. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84 or UL 723, with test specimen preperation in accordance with ASTM E2404.
h. Wall Assembly Burn Test: Where required by code, Air and Water Barrier, as a component of a wall assembly, shall have passed a NFPA 285 complete wall fire test.
i. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
j. Pull Adhesion: Passing at 16 min, when tested in accordance with ASTM D4541.
k. Crack Bridging: Pass, when tested in accordance with ICC-ES AC212 or ASTM C1305
l. Sealants, Tapes and Accessories: As recommended by air and water barrier manufacturer.
m. Products:
    1) Carlisle Coatings and Waterproofing, Inc; Barritech VP: www.carlisleccw.com.
    2) Henry Company; Air-Bloc 17MR, 33MR: www.henry.com/#sle.
    3) STS Coatings, Inc.; Wall Guardian: www.stscoatings.com.
    4) Tremco Commercial Sealants & Waterproofing; ExoAir 230: www.tremcosealants.com.
    5) Substitutions: See Section 016000 - Product Requirements.

2.03 ACCESSORIES

A. Sealants, Tapes, Primers, and Accessories for Sealing Air and Water Barrier and Adjacent Substrates: As indicated or in compliance with air and water barrier manufacturer's installation instructions.

B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air and water barrier materials.
    1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch, nominal thickness.

C. Self-Adhered High Temperature Membrane Through Wall Flashing:
    1. Provide 40 mil self-sealing, high temperature, flexible transition and membrane flashing with damage or puncture resistant film bonded to base adhesive that is:
        a. Butyl or modified asphaltic adhesive chemically compatible with air and water barrier and/or manufacturer's approved primer
        b. Designed to withstand elevated temperatures resisting degradation up to 240 degrees fahrenheit at roof flashing, roof to wall transitions and/or any building condition when installed directly behind dark colored cladding. Adhered flashing membrane per AAMA 711: pass all test criteria as type a (without primer), and modify Section 5.5.3 to level x 240 degrees f (115 degrees c) for 7 days.
        c. Designed to withstand elevated temperatures resisting degradation up 176 degrees fahrenheit at walls, through wall flashing and wall openings. If not otherwise applicable in b. above, adhered flashing membrane per AAMA 711: pass all test criteria as type a (without primer), and level 3, 176 degrees f (80 degrees c) for 7 days.
        d. Applied without flame required
        e. Lap peel strength per ASTM D903.
    2. Provide chemically compatible flexible membrane and transition flashing with air and water barrier material and manufacturer's warranty and associated accessories for:
        a. Flashing at spandrels and cavities; under copings, band courses, and sills.
        b. Windows, doors and other openings.
        c. Over lintels and shelf angles.
        d. At low roof to high wall conditions and all other wall conditions necessary to provide a watertight wall assembly.

3. 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 and water barrier system.
4. Accessories:
    a. Provide manufacturer's surface conditioner and primer.
    b. Provide chemically compatible sealant along all edges of self-adhered flashing sealed in accordance with manufacturer's installation instructions.
    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. Refer to Section 07 6200 for metal through wall flashing drip edges and flashings, including but not limited to metal type, finish and/or gauge, unless otherwise noted in drawings.
5. Coordinate installation with the Exterior Cladding Contractor and other provisions as required in Divisions 04-Masonry, 07-Thermal and Moisture Protection and 08-Openings.

D. Thinners and Cleaners: As recommended by material manufacturer.

E. Backer Rod: ASTM C1330, Type C (closed cell material with a surface skin) and ASTM D5249 Type 3.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready for 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. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

D. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Wall joints less than 1/2" shall be treated with liquid flashing as reccommended by the manufacturer.

C. Wall joints over 1/2" shall be treated with transition material or as reccommended by the manufacturer.

D. Through Wall Flashing:
   1. Install flashing to dry surfaces when air and surface temperatures are 40ºF and above.
   2. All flashings shall be installed to produce a fully watertight assembly.
   3. 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.
   4. Precut pieces of flashing to easily handled lengths for each location.

E. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air and Weater Barriers: Install continuous airtight 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 and water barrier for claddings.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.

E. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.

F. Through Wall Flashings:
   1. General:
      a. Install membrane flashings shingled nd lapped 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) and fully bed sealed at all splices, transitions and end dams.
   2. 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.

3. 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.
4. 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.

G. Openings and Penetrations in Air and Water Barriers:
1. Installation of continuous air and water barrier to return into rough opening as indicated in drawings and extend into rough opening to seal to interior air sealant and backer rod for continuous air seal.
2. Install flashing extending a minimum 4 inches onto vertical wall and into rough opening with fully self adhered transition membrane.
3. Hollow Metal Door Frames: Seal door frame to wall surface with transition membrane.
4. Perimeter wood nailers at wall openings: Cover all exposed surfaces of wood nailers with transition membrane. Extend membrane over wall surface, sheathing, masonry and metal framing.
5. Aluminum frames: Seal frames to the air and water barrier and flashing assemblies.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to air and water barrier.

H. Exterior Expansion Joints in Air and Water 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. At new to existing expansion joints coordinate installation of new infill wall materials after removal of any existing cladding materials, to ensure that expansion joint at air and water barrier plane is in line with expansion joint at exterior cladding.
3. At new to existing expansion joints install air and water barrier materials at new infill wall, extending a minimum of 6 inches onto the existing backup wall and air and water barrier system. Ensure that all terminations of new air and water 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 preformed silicone faced expansion joints, transition membrane flashing and backer rod at gap as indicated in the Drawings, fully stripped in with air and water barrier system in full accordance with manufacturer details and requirements.
6. Expansion joints at air and water 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 014000 - Quality Requirements for additional requirements.

B. Do not cover installed air barriers until required inspections have been completed.

C. Obtain approval of installation procedures from air 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 installation prior to covering up air barriers.

E. Air and Water 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 sunlight, and/or weather longer than established by manufacturer.

B. Provide temporary protection measures as required to protect materials from damage after installation and prior to installation of remaining enclosure work.

END OF SECTION

SECTION 075400
THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with thermoplastic PVC roofing membrane.

B. Flashings.

C. Roofing stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood nailers.

B. Section 07 2200 - Roof and Deck Insulation

C. Section 077200 - Roof Accessories: Roof-mounted units; prefabricated curbs.

1.03 REFERENCE STANDARDS

A. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene with all related trades before starting work of this section.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating membrane materials, sealants, adhesives, flashing materials, fasteners, and other related materials.

C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.

D. A roofing system letter is required which coordinates all roofing components, fasteners and fastening patterns to accommodate the project-specific wind loads and manufacturer's warranty duration.

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions, finish coating installation, special procedures, and perimeter conditions requiring special attention.

F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

G. Warranty Sample:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's certification that installation complies with warranty conditions for waterproof membrane.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with at least five years of documented experience and approved by manufacturer.

C. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

D. Roof System shall meet minimum requirements in accordance of ASCE 7 per code jurisdiction.

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1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 100 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Special Warranty: Manufacturer's standard or customized form, without monetary limitation,(“NDL”) in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.
   2. Contractor’s Workmanship Warranty: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyvinyl Chloride (PVC) Membrane Roofing Materials:
   1. Carlisle Roofing Systems, Inc: www.carlisle-syntec.com/sle.
   2. GAF;: www.gaf.com/sle.
   3. Johns Manville: www.jm.com.
   4. Sika Corporation Roofing; Sarnafil PVC: usa.sarnafil.sika.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation:
   1. Reference Section 07 2200 - Roof and Deck Insulation

2.02 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

A. Membrane Roofing Materials:
   1. PVC: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M, Type III, sheet contains reinforcing fibers or reinforcing fabrics; fully adhered.
      a. Thickness: 60 mil, 0.060 inch, minimum.
      b. Provide 0.080 inch, (80 mil) minimum at kitchens or where noted on the plan.
   2. Sheet Width: Factory fabricated into largest sheets possible.
   3. Solar Reflectance: 0.75, minimum, initial, and 0.65, minimum, 3-year, certified by Cool Roof Rating Council.
   4. Thermal Emissivity: 0.80, minimum, initial, and 0.79, minimum, 3-year, certified by Cool Roof Rating Council.
   5. Color: White.

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B. Seaming Materials: As recommended by membrane manufacturer.

C. Flexible Flashing Material: Same material as membrane.

2.03 DECK SHEATHING AND COVER BOARDS

A. Reference Section 07 2200 - Roof and Deck Insulation

2.04 INSULATION

A. Reference Section 07 2200 - Roof and Deck Insulation

2.05 ACCESSORIES

A. Roofing Expansion Joint Flashing: Sheet metal, as specified in Section 076200.

B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

C. Membrane Adhesive: Low VOC as recommended by membrane manufacturer.

D. Manufacturer's reinforced liquid flashing system.

E. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

F. Thinners and Cleaners: Low VOC as recommended by adhesive manufacturer, compatible with membrane.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

H. PVC Coated Metal, white.

I. Strip Reglet Devices: Galvanized steel, maximum possible lengths per location, with attachment flanges.

J. Sealants: As recommended by membrane manufacturer.

K. Roof Drains:
   1. Primary Roof Drains and secondary overflow scuppers or roof drains as specified shall be as specified in Division 22 – Plumbing Piping in sizes as indicated on the plumbing drawings. The furnishing of the roof drains will be the responsibility of the Plumbing Contractor and specified in Division 22.

L. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

M. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Roofing membrane manufacturer's standard.
   2. Size: 18 by 18 inch.
   3. Surface Color: White or yellow.
   4. Provide around all mechanical and HVAC equipment and other locations shown on the roof plan.

N. Termination Bars: Pre-drilled, stainless steel or aluminum, approximately 1" wide X 1/8" thick, with anchors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

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D. Verify deck surfaces are dry and free of snow or ice and/or water, dew, etc.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and nailing strips and reglets are in place.

F. If a fastened system is to be utilized, a fastener-pullout testing is to be performed as a pre-construction activity as a mechanism to inform the design.

3.02 FIELD QUALITY CONTROL

A. Require site attendance of roofing and insulation material manufacturers minimum of 3 times during installation of the Work.

B. Field quality control performance testing is required, including wind uplift testing per FM 1-52 and moisture testing per ASTM standards for infrared thermography, impedance or nuclear scanning.

C. Electronic Leak Detection (ELD) Testing: Test roofing areas for leaks using ELD method that locates discontinuities in membrane roofing in accordance with ASTM D8231.
   1. Testing agency to provide training certification from testing equipment manufacturer to ensure that technician performing ELD testing is currently certified in accordance with training program of testing equipment manufacturer.
   2. Manufacturers:
      a. Detec Systems; Electronic Leak Detection Quality Control Testing - IntegriScan: www.detecsystems.com/#sle.
      b. IR Analyzers / Vector Mapping; High Voltage ELD: www.iranalyzers.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.

D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

E. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

3.03 CLEANING

A. Remove all markings from finished surfaces.

B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

C. Contractor shall power wash the roof upon completion to remove all construction related dirt and debris.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.04 PROTECTION

A. Protect installed roofing and flashings from construction operations and trades.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART I - GENERAL

1.01 WORK INCLUDED

A. Install flashing and sheet metal as indicated on Drawings and in these specifications as required for a complete and proper installation. The following items are included:
   1. Edge metal and fascia metal.
   2. Gutters and downspouts.
   3. Painted cast iron downspout boots.
   4. Sheet metal counterflashing.
   5. Curb flashing for pipe penetrations.
   6. Sheet metal counterflashing.
   7. Roof mounted mechanical equipment flashing.
   8. Square to round sheet metal flashing for vent stacks.
   9. Expansion joint covers and area divider covers.
   10. Sheet metal embedded wall flashings and through wall flashings.

1.02 RELATED WORK

A. Section 06 1000 - Rough Carpentry

B. Section 07 2200 - Roof and Deck Insulation

C. Section 07 5216 - SBS Modified Bituminous Roofing

D. Section 07 5419 - Polyvinyl Chloride (PVC) Membrane Roofing

E. Section 07 7200 - Roof Accessories

1.03 REFERENCE STANDARDS

A. ANSI/SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

1.04 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01 3000.

B. Describe material profile, jointing pattern, jointing details, fastening methods, and installation details.

C. Submit samples under provisions of Section 01 3000.

D. Sealant product data and color chart(s).

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA and NRCA standard details and requirement.

1.06 QUALIFICATIONS

A. Company specializing in sheet metal flashing work with a minimum of 10-years documented experience.

1.07 STORAGE AND HANDLING

A. Stack pre-formed materials to prevent twisting, bending, or abrasion, and to provide ventilation.

B. Prevent contact with materials during storage that may cause discoloration, staining, or damage. Materials damaged by improper storage techniques, including “white rust” will be rejected and replaced at Contractor’s expense.

1.08 WARRANTY

A. Sheet Metal work and accessories to be included in Two-Year Contractor’s Warranty.

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B. Provide pre-finished metal manufacturer's 20-year finish guarantee.

C. Provide pre-finished metal manufacturer's 20-year galvanized steel guarantee.

PART 2 - PRODUCTS

2.01 SHEET METALS

A. Sheet metal flashing: 24 gauge galvanized steel. Refer to Section 07 5419 for membrane coated 24 gauge galvanized steel.

B. Pre-finished metal: 24 gauge galvanized steel, Kynar 500 finish. Color selection available from standard and premium colors.

C. Galvanized metal: 20 and 22 gauge galvanized steel, minimum G-90 coating thickness per ASTM A 653.

D. Stainless steel metal: 24 gauge, Type 304, 2b Finish, ASTM A240.

2.02 SHEET METAL COMPONENTS

A. Receivers and Counterflashing:
   1. Curbs: 24-gauge stainless steel and/or galvanized steel, or as noted in the Drawings.
   2. Walls: 24-gauge prefinished galvanized steel or as noted in the Drawings.

B. Copings, Edge flashing, Expansion Joint Covers, Gutters, Scupper Trim, Conductor Heads and Downspouts: Pre-finished 24 gauge galvanized steel.

C. Splash Pan: 24 gauge galvanized steel splash pan, where downspout discharges on adjacent roof level, adhered to protection pad.

D. Two-piece fascia extension profile is required whenever fascia vertical height exceeds 8 inches or as required to meet ANSI/SPRI ES-1. Multiple piece fascia conditions will be equally sized and installed.

E. Cover Plates, End Caps and Miscellaneous Sheet Metal: Same materials, gauge and profile as edge metal or expansion joint material.

F. Gutter Straps and Brackets: 1/8" x 1" galvanized steel, wrap brackets with prefinished metal to match gutter.

G. Cast Iron Downspout Boots: Barry Pattern and Foundry, model and size to coordinate with downspout size specified, or approved equivalent, 3'-0" height. Coordinate model to accommodate discharge to below grade piping if present, otherwise provide discharge at grade. Provide boots at all locations where downspouts discharge at ground level or connect to below grade storm sewer piping.
   1. Downspout Boot Anchors: Hilti HY20 stainless steel threaded rod adhesive anchor system, or approved equivalent.

H. Splash Pan: 24 gauge galvanized steel splash pan, where downspout discharges on adjacent roof level, adhered to protection pad. Provide at every downspout discharging to roof surfaces.

I. Splash Block: precast concrete splash block, 2'-0" length x 1'-0" width, minimum. Provide at all locations where downspout discharges at non-paved surfaces at ground level.

J. Cleats: Minimum 20 gauge galvanized steel or as noted in the Drawings.

K. Hoods for Pipe Penetration Curbs: 24 gauge galvanized steel.

L. Square to Round Flashings: Minimum 24 gauge stainless steel.

M. Embedded Wall Flashings:
   1. Flashing at Openings:
      a. 20 gauge stainless steel, size and configuration as indicated in the Drawings.
      b. Provide shop fabricated corners at head and jamb intersections with all joints soldered. Provide double bead continuous sealant at all other joints.
   2. Drip Edge Flashings at Openings:

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a. Head, jamb, and sill flashing extension: 24 gauge prefinished galvanized steel or .050” prefinished aluminum, as required to match adjacent finishes.
b. Sill flashings at storefront/curtainwall: 24 gauge stainless steel, with fully sealed end dams.
c. All joints lapped and sealed.

3. Through Wall Flashings with Drip Edge: Minimum 24 gauge stainless steel.

2.03 ACCESSORIES

A. Solder: ANSI/ASTM B 32 50/50 type.

B. Blind Pop-Rivets: Stainless steel, with stainless steel mandrels. Exposed pop-rivets shall be pre-finished to match the color of sheet metal.

C. Clamping Collar: Stainless steel of size necessary to fit over vent or pipe circumference, as applicable.

D. Umbrella flashing: 26 gauge stainless steel, premanufactured soldered flashing, Umbrella Bell Cap Model UMB-BELL as manufactured by SBC Industries.

E. Self-Adhered/Underlayment Membrane: High-temperature, high strength membrane composed of asphalt or butyl rubber adhesive with a top layer of laminated polyethylene, 30 – 60 mils, ASTM D1970. Membrane shall be approved by the manufacturer for the intended application.

F. Liquid Membrane: Two component, elastomeric, cold applied liquid membrane compatible with self-adhered membrane.

G. Aluminum Foil Tape: 3M aluminum foil tape 425, or as required by the manufacturer.

H. Sealant Tapes: Polyisobutylene butyl elastic tape, minimum 1/8-inch thickness and 3/4-inch width.

I. Batt Insulation: for use at expansion joint retainer flashings, fiberglass batt insulation, unfaced, ASTM C665.

J. Gutter Screen: Square, Stainless Steel, Type 304, Woven - Plain Weave, 0.2500" x 0.2500" Opening (Square), 0.120" Thick (11 Gauge) Wire Diameter, 46% Open Area minimum. McNichols or approved equivalent manufacturer.

K. Paint System:
1. Primer: Kem Kromik Universal Metal Primer or approved equivalent.
2. Paint/Coating: Sherwin-Williams Sher-Cryl HPA or approved equivalent.
3. Color: to match existing.

2.04 SEALANT

A. Type I: Application exposures to sunlight, ASTM C-920-87, Federal Specification TT-S-00230-C one component gun-grade polyurethane sealant suitable for continuous immersion and resistant to asphalt products.

B. Type II: Applications not exposed to sunlight, butyl rubber based.

C. Hot vent sealant: A one component neutral moisture curing silicone sealant.

D. Primer: As required by sealant manufacturer.

E. Colors: Sealants to match color of metal or substrate.

2.05 SCHEDULE OF FASTENERS

A. Exposed fasteners: Shall be stainless steel with stainless steel bonded neoprene or EPDM washers. Exposed fastener heads shall be pre-finished to match the color of sheet metal.

B. Fasteners shall be compatible to all materials to which they come in contact.

C. Cleat, Counter-flashing, and Surface Fastened Components.
1. Wood Substrate: No. 10 stainless steel wood screws with stainless steel bonded neoprene washers of length necessary to penetrate wood substrate one inch.

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2. Metal Substrate: Minimum No. 10 stainless steel sheet metal screws or as necessary to suit application with stainless steel bonded neoprene washers.
3. Concrete or Masonry Substrate:
   a. Flashings: 3/16” diameter, stainless steel Tapcon Concrete/Masonry Anchors or approved equivalent, length sufficient to provide 1” min. embedment into substrate.

2.06 FABRICATION

A. Form sections to match existing profiles, true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate continuous cleats and starter strips of same material as sheet, inter-lockable with sheet.

C. Fabricate expansion joint covers and coping with 1-inch standing seams.

D. Form pieces in longest practical lengths.

E. Hem exposed edges of metal 1/2-inch; miter and seam corners.

F. Form materials with cover plate seam.

G. Fasten and seal metal joints.

H. Fabricate corners from one piece with minimum 18-inch and maximum 36-inch long legs; fasten for rigidity, seal with sealant.

I. Fabricate vertical faces with bottom edge formed outward 1/4-inch and hemmed to form drip.

J. Form edge metal/fascia as existing profiles as specified herein and as shown on Drawings.

K. Form sections square, true, and accurate in size, in maximum possible lengths and free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

L. Enlarge holes for fastening counter flashing, coping, and pressure bars as necessary to allow for thermal expansion and contraction. Cover exposed holes with appropriate washers.

M. All fabrication, installation, terminations, and transitions of sheet metal shall be in accordance with the latest published SMACNA and NRCA guidelines and recognized roofing and sheet metal industry standards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, and cant strips in place, and nailing strips located.

B. Verify membrane termination and base flashings are in place, sealed, and secure.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Field measure site conditions prior to fabricating work.

B. Apply protective membrane backing on surfaces in contact with dissimilar materials, including between existing steel decks and treated wood.

C. Tie-ins or contact with dissimilar metals: Install separation layer of elastomeric membrane between metal surfaces.

3.03 INSTALLATION - GENERAL

A. Provide flashings of materials indicated on Drawings at all junctures of the roof with perimeters, curbs, mechanical, electrical equipment, etc., that a completely watertight installation is achieved.

B. Fabricate and install sheet metal work with lines, arises and angles sharp and true, and plane surfaces free from warps and buckles. Bead or return all exposed edges.

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C. Soldering: Tin metal for full area of contact on soldered seams and joints. Do soldering slowly with well heated coppers and stainless steel metals, thoroughly heating seams and completely filling them with solder.

D. Prime all sheet metal to receive roofing in accordance with manufacturer's requirements.

E. Apply bed of water cutoff mastic directly below sheet metal that is set over roofing membrane or in other areas as required by the Drawings, and the manufacturer's specifications.

F. Submit details not covered in Drawings for approval by Owner or A/E.

G. Install starter and edge strips, and cleats before starting installation.

H. Secure flashings in place using concealed fasteners. Use exposed fasteners only in locations approved by A/E.

I. Lock and seal all joints.

J. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

K. Fasten sheet metal with approved fasteners at a minimum of 12 inches on centers unless otherwise specified in these Specifications or the Drawings.

L. Install back-up and cover plates in accordance with SMACNA and as described in the Construction Documents.

3.04 COPING AND EXPANSION JOINT INSTALLATION

A. Coordinate installation of roofing materials at copings and expansion joint conditions to ensure a continuous air seal, installed at air barrier system at walls and continuous through roof conditions as detailed in the Drawings.
   1. Notify A/E when continuous air seal assembly is ready for review at roof to wall transitions prior to proceeding with installation of roof flashings that would conceal this condition.

B. Fabricate and install these flashings according to the Drawings, latest published SMACNA and NRCA guidelines, and in accordance with recognized roofing and sheet metal industry standards.

C. All horizontal joints shall have a 1" standing seam as shown in the Drawings.

D. Vertical flanges shall have a minimum height of three (3) inches. High side (outside) shall be cleated continuously; other side mechanically fastened as shown on the drawings.

E. All corners shall be shop mitered, and all shall not be more than two feet beyond a corner in either direction.

F. Provide a minimum slope of 1" per foot at copings and 2" per foot at expansion joint flashings.

3.05 TWO-PIECE COUNTERFLASHING INSTALLATION

A. Secure counterflashing receiver over base flashing to substrate with appropriate fasteners. Secure counterflashing to receiver with stainless steel screws with bonded neoprene washers spaced 12-inches on centers.

B. Pop-rivet and solder all seams of galvanized or stainless steel two-piece counterflashings, pop rivet and seal seams of prefinished galvanized steel.

3.06 METAL EDGE FLASHING INSTALLATION

A. Install edge flashing in a uniform application of compatible sealant over roof membrane.

B. Apply sealant, Type I, under cover plates at all joints prior to installation.

C. Fasten horizontal flange in a staggered pattern on three-inch centers.

D. Strip-in edge flashing as specified in membrane roofing sections.

E. Install compatible sealant along finished edge of stripped in membrane at all metal edge flashings.

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3.07 CLEAT INSTALLATION

A. Install cleats for edge/coping flashing with appropriate fasteners on six-inch centers.

3.08 PIPE PENETRATION FLASHINGS

A. Pipe penetrations for electrical, refrigerant, and gas lines shall be through raised wood curbs with a minimum height of 12” above the plane of the finished roof, in accordance with Drawings.

B. Vent pipe penetrations shall be flashed with manufacturer’s pre-formed pipe flashing, secured with a stainless steel clamping ring, with sealant inside the flashing behind the ring and on top of the ring.
   1. An additional 24 gauge galvanized steel umbrella flashing shall be installed as specified in the Drawings to cover the top of the preformed flashing by three (3) inches.
   2. Umbrella flashing shall be secured with a second clamping ring and silicone sealant applied to the top edges.

3.09 CONDUCTOR HEAD, GUTTER AND DOWNSPOUT INSTALLATION

A. Fabricate gutters and downspouts to sizes indicated in the Drawings.

B. Joined components with formed seams sealed watertight. Provide soldered stainless steel downspout collar at downspout connection.

C. Flash and seal gutters and conductor heads to downspouts and accessories.

D. Seal metal joints wateright for full metal surface contact. Rivet and apply Type II sealant between joints of metal.

E. Gutters:
   1. Install gutter support brackets under gutters and mount gutters to provide 1/16” minimum per foot slope to downspouts.
   2. Install gutter spacers as indicated in the Drawings.
   3. Provide gutter expansion joints at the locations indicated in the Drawings, at all gutter lengths greater than 50’-0”. Locate joints at high points of gutters between downspouts.
   4. Flash and seal gutters to downspouts and accessories. Apply sealant between gutter base and downspout flanges prior to securing with stainless steel pop rivets. Do not apply excess/additional sealant on top of downspout flange.

F. Downspouts:
   1. Provide downspout straps anchored at 4’-0” o.c. maximum.
   2. Downspout Boot Installation:
      a. Paint exterior surface of boot to match downspouts.
      b. Install boot with adhesive anchor system in accordance with anchor manufacturer requirements; align boot with below grade piping for flexible connection by Civil.
      c. Seal gaps between downspout and boot with backer rod and spray foam and silicone sealant tooled to shed water.

G. Test gutters and downspouts for leaks after full cure of sealants. Repair all leaks at metal joints by cleaning, priming, and reapplication of sealant.

3.10 SCUPPER INSTALLATION

A. Field verify existing conditions at opening to receive scupper. Shop fabricate and solder all joints in scupper assembly, to consist of the sleeve through the wall assembly with a minimum 4” wide flange at the roof membrane on all sides. Provide lapped, riveted joints at other locations as required for completed assembly as indicated on Drawings.

B. Secure scupper to surrounding wall and roof substrates, using fasteners appropriate for the application, at 6” o.c. maximum, with not less than 3 fasteners per side.

C. Provide full seal at perimeter of scupper at air barrier membrane around scupper within wall assembly, and provide seal at termination of scupper at exterior wall surfaces as indicated in the Drawings.

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3.11 EMBEDDED WALL FLASHING INSTALLATION

A. General: set all embedded wall flashings in a continuous bead of sealant against wall substrates prior to securing flashings in place.

B. Flashings at head, jamb, and sill conditions:
   1. Verify that air barrier membrane detailing at opening is complete at all surfaces to receive flashings. Refer to the Drawings and Section 07 2500, “Weather Barriers”.
   2. Install flashings as indicated in the Drawings at head, jamb and sill conditions. Provide full bed of sealant between all flashings and substrate to receive flashing. Minimum lap width 6”.
   3. Fasten flashings at 16” o.c. maximum, ensuring fasteners engage framing components for proper and snug attachment. Ensure that fastener heads are flat and installed flush with flashing metal.
   4. Provide two beads of continuous sealant at all laps in flashings at head, jamb, and sill conditions. Seat metal pieces such that full embedment in sealant is achieved at laps. Minimum lap width 6”. Provide rivets as required to hold flashing components in place until sealant cure.
   5. Provide shop fabricated, soldered corners and install at intersections of head, jamb and sill flashings. Set corners in full bed of sealant. Rivet edges of corners to adjacent flashings as required to maintain full contact of sheet metals at lap until full sealant cure.
   6. Attach metal flashings and corners to substrate as required to secure to substrate with no protruding edges. Ensure installed condition is acceptable to air barrier manufacturer for strip in installation.

C. Drip edge flashings at openings:
   1. Verify that air barrier membrane detailing is complete at all surfaces to receive flashings. Refer to the Drawings and Section 07 2500, “Weather Barriers”.
   2. Install flashings as indicated in the Drawings.
      a. Sill Flashings: Ensure that end dams sit snug against jamb substrate with air barrier flashings in place, with a full bed of sealant present. Seal top edge of end dam to air barrier flashing surface. Where prefinished sill extension is present, install after completion of cladding materials. Secure to drip edge and continuous cleat at cladding surface.
      b. Drip flashings at head conditions: Ensure that prefinished surface of flashing faces exterior. Do not install drip flashing in a manner that interferes with perimeter window sealant bond to air barrier flashings at opening.
   3. Fasten flashings at 16” o.c. maximum, ensuring fasteners engage framing components for proper and snug attachment. Ensure that fastener heads are flat and installed flush with flashing metal.
   4. Provide two beads of continuous sealant at all laps in flashings. Seat metal pieces such that full embedment in sealant is achieved at laps. Provide rivets as required to hold flashing components in place until sealant cure. Minimum lap width 6”.
   5. Attach metal flashings and corners to substrate as required to secure to substrate with no protruding edges. Ensure installed condition is acceptable to air barrier manufacturer for strip in installation.

3.12 THROUGH WALL FLASHING INSTALLATION

A. Fabricate stainless steel through wall flashing based on field verification as indicated in the drawings, with horizontal leg extending 1/2" maximum beyond masonry surface.

B. Clean and prime substrates to receive flashing, and install flashing in a full bed of sealant.
   1. Fasten flashings to backup walls at 16" o.c. maximum and to masonry or concrete walls at 12” o.c. maximum with flat head stainless steel screws.
   2. Provide a minimum lap of 6" between sections. Provide continuous double beads of sealant at laps and secure with rivets.

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3. Fully solder or seal all joints at end dams and transitions.
4. Provide end dams at all terminations to openings, transitions in height, and expansion joint conditions.

C. Install through wall flashing membrane in accordance with Section 07 2500.

3.13 CLEANING

A. Remove markings from all exposed sheet metal.

END OF SECTION

SECTION 077200
ROOF ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Installation of rooftop supports at all pipe/conduit, duct, and non-curbed roof mounted equipment.
   2. Installation of non-penetrating equipment platforms and access stairs.
   3. Furnishing and installing roof hatch, hatch safety rails, ladder access pole and wall mounted ladders at roof hatch and at exterior wall between roofs.

1.03 REFERENCES

A. Ladders:
   1. AA – Aluminum Association.
   2. ANSI A14.3 – American National Standard for Ladders – Fixed – Safety Requirements.
   3. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   4. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   5. ASTM B 308 – Standard Specification for Aluminum – Alloy T6061-T6 Standard Structural.
   6. OSHA 29 CFR Standard OSHA 1910.27 – Fixed Ladders.

B. Roof Hatches, Safety Rail:
   1. OSHA 29 CFR Standard OSHA 1910.26.500-503.
   2. OSHA 29 CFR Standard OSHA 1910.23.

1.04 SUBMITTALS

A. Pre-Installation Submittals:
   1. Product Data: Submit for all products proposed for use, describing physical characteristics and method of installation.
   2. Shop Drawings:
      a. Dimensioned Shop Drawings: Before beginning fabrication of equipment submit scaled shop drawings showing layout, profiles, and product components, including anchorage, accessories and finish, along with general arrangement of the equipment and their working positions.

B. Closeout Submittals:
   1. Provide applicable manufacturer’s warranties prior to the contract closeout.
   2. As-built shop drawings noting changes made during installation.
   3. Maintenance information.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed specified system installations similar in material and extent to that indicated for this Project with a record of successful in-service performance.

B. Manufacturer Qualifications: Company specializing in the engineering and manufacturing of specified roof accessory products, with not less than ten years of experience.

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1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials in accordance with manufacturer's printed instructions. Deliver materials in manufacturer's original wrappers, dry, and undamaged with seals and labels intact.

B. Damaged materials (moisture, fire, or other) resulting from noncompliant storage practices shall be removed and replaced at Contractor's expense.

1.07 WARRANTY

A. Manufacturer's standard warranty: Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge. Electrical motors, special finishes, and other special equipment (if applicable) shall be warranted separately by the manufacturers of those products.

PART 2 - PRODUCTS

2.01 EQUIPMENT SUPPORTS, PLATFORMS, ACCESS STAIRS

A. Manufacturer:
   1. Acceptable Manufacturer: PHP Systems/Design i.e. Portable Pipe Hangers; 5534 Harvey Wilson Drive, Houston, Texas 77020. ASD. Tel: (800) 797-6585. Fax: (713) 672-1170. www.phpsd.com. Email:info@phpsd.com.
   2. Pre-bid approved equivalent.

B. APPLICATIONS
   1. Support pipes, conduit, cable trays, and ducting, a minimum of 8 inches (203 mm) above roof surface.
   2. Support Spacing: 10 feet MAXIMUM.
   3. For Electrical and Gas Lines 3-1/2 inches (89 mm) in diameter or less, up to 16 inches (406 mm) above roof; Portable Pipe Hanger Model number PP10.
   4. For Gas Lines 4 to 6 inches (100-150 mm) in diameter, up to 12 inches (305 mm) above roof; Portable Pipe Hanger Model number RB18.
   5. For single Electrical and Gas Lines 3 to 8 inches (80-200 mm) in diameter; Portable Pipe Hanger Model number PS 1-2.
   6. For Multiple Lines: Portable Pipe Hanger Model number PSE custom.
   7. Accessories for PSE Custom and Other Applications when required.
      a. Un-insulated Piping: Roller support or clevis hanger.
      b. Insulated Piping: Band hanger supported from horizontal channel or clevis hanger with Insulation Protection Shield.
      c. Conduit: Band hanger supported from horizontal channel.
      d. Bracing required when using base with swivel; when pipe exceeds 24 inches (610 mm) above roof, or when thermal expansion of pipe is great.
   8. Equipment Platforms shall consist of Portable Pipe Hanger Model PHP Equipment Platforms.
   9. Equipment supports shall consist of Portable Pipe Hanger Model number RTU-20.
      a. Support Spacing: Install supports at locations indicated on the Drawings.

C. Portable Support System: Engineered, portable system specifically designed for installation without the need for roof penetrations, or flashings, and without causing damage to the roofing membrane.
   1. Design system using high density, high impact polypropylene bases with carbon black, anti-oxidants for UV protection, and G-90 galvanized steel framing of 1-5/8 inch (41 mm) B22TH or 1-7/8 inch (48 mm) BTS22TH for support.
   2. Custom design system to fit piping, conduits, equipment to be installed and actual conditions of service and loading.
      a. Piping Supports: Provide suitable hangers and supports.

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b. Equipment Supports: Factory fabricated to support exact duct sizes and equipment to be installed.

D. Bases: Injection molded high density, high impact polypropylene with UV-inhibitors and anti-oxidants, conforming to the following:
1. Moisture Content: Negligible.
2. Shrinkage/Swelling Due to Moisture: Negligible.
3. Density: 55.8 lb/cu ft (894 kg/cu m).
4. Insect Resistance: No known insect damage potential.
5. Chemical Resistance (oil, brake fluid, gasoline, diesel, antifreeze, battery acid, and sulfuric acid) No visual or physical change apparent.
6. Flammability: No ignition after 10 minutes, 25 kW/m, when tested in accordance with ASTM D 1929.
7. Sized as required by loading conditions and as indicated on the drawings.
8. Shop fabricated with inserts for square tubing or threaded rods as required.
9. Color: Integral black color as molded.
10. Bases for Mechanical Attachment: Sealant chamber around penetration point, with injection port for sealing after fastening; beveled lip for sealant bead around entire diameter.
11. Do not use bases containing carbonated plastics, press molded recycled rubber and plastics, steel, stainless steel, or any injection molded threaded receivers.

E. Pipe Supports and Hangers: Conform to MSS SP-58 and MSS SP-69 and as follows:
1. Fabricated of G-90 galvanized steel where framing is carbon steel; fabricated of stainless steel where framing is stainless steel; finished same as framing.
2. Sizes 2-1/2 inch (63 mm) and smaller: Single roller supports for piping subject to expansion and contraction; 3-sided channels and pipe clamps.
3. Sizes 3 inch (76 mm) and larger: Rollers, clevis hangers, or band hangers, to allow for expansion and contraction without movement of the bases or framing.

F. Stainless Steel Framing:
1. Channel Types: 1-5/8 inch (41.3 mm) or 1-7/8 inch (47.6 mm), as required for loading conditions.
2. Thickness: 12 gauge (2.7 mm).
3. Form: Roll-formed 3-sided or tubular channel.
4. Finish: Mill finish.
5. Do not use tubing or tube steel.

G. Accessories: Clamps, bolts, nuts, washers, and other devices as required for a complete system.
1. Stainless Steel: Mill finish.
2. Welded Steel Grating:
a. Metal Bar Grating Standards: Comply with NAAMM MBG 531 “Metal Bar Grating Manual”.
b. Bearing Bar Spacing: 15/16 inch (24 mm) o.c.
c. Bearing Bar Depth: As required to comply with structural performance requirements.
d. Bearing Bar Thickness: As required to comply with structural performance requirements.
e. Crossbar Spacing: 4 inches (102 mm) o.c.
f. Grating Mark: as indicated.
g. Traffic Surface: Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy resin adhesive.
h. Steel Finish: Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface.
3. Ballast:

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a. Hanover Architectural Products, Standard Walkway and Ballast Paver, or equivalent concrete paver with a minimum weight of 23 psf.

4. Provide one (1) paver on each side of condensing unit secured to welded steel grating, for a total of two (2) pavers. Provide stainless steel straps to secure pavers to grating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Ensure that surfaces and site conditions are ready to receive Work and are acceptable to membrane manufacturer for required warranty.

3.02 INSTALLATION – EQUIPMENT SUPPORTS, PLATFORMS, ACCESS STAIRS

A. Install in accordance with manufacturer's instructions.

B. Clean surfaces of roof in areas to receive portable support bases.

C. Remove dirt, dust, oils, and other foreign materials.

D. Use care in handling portable support system components during installation, to avoid damage to roofing, flashing, equipment, or related materials.

E. Pipe, Cable, and Equipment Support Systems
1. Locate bases and support framing as indicated on drawings and as specified herein. Provide complete and adequate support of all piping, ducting, and conduit, whether or not all required devices are shown.
2. The use of wood for supporting piping is not permitted.
3. Provide support spacing so deflection of piping does not exceed 1/240 of span.
4. Install framing at spacing indicated, but in no case at greater than 10 feet (3 m) on center.
   a. Accurately locate and align bases.
   b. Consult manufacturer of existing or new roofing system as to the type of protection pads required between the roof and base.
   c. Adhere bases to protection pads.
5. Set framing posts into bases and assemble framing structure as indicated.

F. Equipment Supports:
1. Locate bases and support framing as indicated on Drawings and as specified herein. Provide complete and adequate support of all structures.
2. Accurately locate and align bases.
   a. Consult manufacturer of existing or new roofing system as to the type of isolation pads required between the roof and base.
   b. Adhere bases to roof membrane manufacturer approved protection pads in accordance with roof membrane manufacturer’s installation requirements.
3. Set legs of substructures into bases as indicated.
4. Secure equipment and ballast to welded steel grating with stainless steel fasteners. Provide additional framing secured to platform for electrical disconnect boxes.

G. When requested by the Architect, provide a factory-trained representative of the manufacturer to visit the site while the work is in progress to assure that the installation conforms to the manufacturers design and installation requirements.

H. Curbs and penetrations shall not inhibit the drainage plane of the roof and are not located within 2" of roof valleys or ridges.

3.03 CLEANING AND PROTECTION

A. Remove all packaging, unused fasteners, adhesive and other installation materials from the project site.

B. Remove adhesive from exposed surfaces of supports and bases and leave the work area in clean condition.

C. Provide protection as required, leaving the work area in undamaged condition at the time of completion of work.

END OF SECTION

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SECTION 078400
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 .

1.02 RELATED REQUIREMENTS

A. Section 01 1400 - Work Restrictions

B. Section 01 4533 - Code-Required Quality Control

C. Section 017000 - 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. FM (AG) - FM Approval Guide; current edition.

F. FM 4991 - Approval Standard for Firestop Contractors; 2013.

G. ITS (DIR) - Directory of Listed Products; current edition.

H. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

I. UL (FRD) - Fire Resistance Directory; Current Edition.

J. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - 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.

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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 016000 - 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 firestoppping 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.

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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:

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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.

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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

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SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. 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 C834 - Standard Specification for Latex Sealants; 2017.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

G. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.

I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

J. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

K. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

1.04 SUBMITTALS

A. See Section 013000 - 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.

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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.

D. Stain testing required as recommended by manufacturer.

1.06 WARRANTY

A. See Section 017800 - 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 016000 - Product Requirements.

B. Self-Leveling Sealants:

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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 016000 - 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 NONSAG JOINT SEALANTS

A. Type EJS-1 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
4. Color: Match adjacent finished surfaces.
5. Service Temperature Range: Minus 20 to 180 degrees F.

B. Type EJS-1 - Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.
4. Service Temperature Range: Minus 65 to 180 degrees F.

C. Type IJS-2 - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
3. Color: Match adjacent finished surfaces.
4. Service Temperature Range: Minus 40 to 180 degrees F.

D. Type IJS-3 - Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
2. Color: As scheduled.
3. Service Temperature Range: Minus 40 to 180 degrees F.

E. Type IJS-4 - Tamper-Resistant Polyurethane Sealant: ASTM C920, Grade NS, Uses M, G, and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Color: Match adjacent finished surfaces.
2. Service Temperature Range: Minus 40 to 180 degrees F.

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F. Type IJS-1 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: Standard colors matching finished surfaces.
   2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).

G. Type EJS-2, EJS-3 - Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

2.04 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. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   2. Color: Gray.
   3. 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. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   2. Color: Gray.
   3. 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.

2.05 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. Vertical: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   2. 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.

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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

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SECTION 079513
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 031000 - Concrete Forming and Accessories: Placement of joint cover assembly frames in formwork.

B. Section 042000 - 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; 2020.

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 013000 - 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.

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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. Erie Metal Specialties, Inc.: www.eriemetal.com.
   5. Inpro: www.inprocorp.com/#sle.
   6. MM Systems Corp: www.mmsystemscorp.com.
   7. Nystrom, Inc: www.nystrom.com.
   8. Watson Bowman Acme Corp.: www.watsonbowmanacme.com.
   9. Substitutions: See Section 016000 - 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 016000 - 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 016000 - 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 080671

DOOR HARDWARE SCHEDULE

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 references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware”.
2. Division 28 Section “Integrated Access Control Hardware Devices”.

D. Codes and References: Comply with the version 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: Reference Related Sections for requirements regarding compliance with applicable industry standards.

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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.

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. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. 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.

E. 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. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

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F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

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, access control credentials, software 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".

1.5 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.

1.6 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.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door 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.

1. Quantities listed are for each pair of doors, or for each single door.

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2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

1. Section 08 71 00 – Door Hardware.

C. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SA - SARGENT
4. MC - Medeco
5. NO - Norton Rixson
6. RO - Rockwood
7. OT - Other
8. SU - Securitron

Hardware Sets

Not for bidding purposes

Set: 3.0
Description: Pair - Exterior Alum -MELR Exit Device-NL/DT - Mullion - Closer w/Stop Arm - Access Control

2	Continuous Hinge	CFM SLF-HD1 SER*		PE
1	Removable Mullion	L980 (12-as req)	PC	SA
1	Exit Device (exit only)	55 8810 862	US32D	SA
1	Rim Exit Device, Storeroom	55 56 70 8804 862	US32D	SA
2	Small Format Inter Core	33700006N P MK	26	MC
1	Cylinder - Mullion	70- 980C1	US26D	SA
2	Door Closer	281 CPS	EN	SA
2	Kit	581-2	EN	SA
2	Mtg Plate	as required	EN	SA
1	Astragal	By the door manufacturer		OT
2	Sweep	18061CNB x Dr. Width		PE
1	Panic Threshold	2005AT MSES25SS x Opening Width		PE
2	ElectroLynx Harness	QC-C1500		MK
2	ElectroLynx Harness	QC-CXXP		MK
1	Power Supply	AQD Series		SU
2	DPS	By Security Contractor		OT
1	Card Reader	By security contractor		OT
1	Perimeter Seals	By the frame manufacturer		OT

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Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts latches on the exit devices for entry. Free egress at all times. Door status monitored.

Set: 8.0
Description: Pr Exterior Rated -SN200 NL x DT- Closer w/Stop Arm - Sound

2	Continuous Hinge	CFM HD1 SER*		PE
1	Removable Mullion	L980 (12-as req)	PC	SA
1	Rim Exit Device	12 70 56-SN200-8804 BIPS-0E 862	US32D	SA
1	Rim Exit Device, Dummy	12 55 8810 862	US32D	SA
2	Small Format Inter Core	33700006N P MK	26	MC
1	Cylinder - Mullion	70- 980C1	US26D	SA
2	Door Closer	281 CPS	EN	SA
2	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Astragal Set (2)	303AS		PE
1	Rain Guard	346C		PE
1	Gasketing	2891AS (head & jambs)		PE
2	Door Bottom	STC411APK		PE
2	Sweep	18061CNB x Dr. Width		PE
1	Panic Threshold	2005AT MSES25SS x Opening Width		PE
2	ElectroLynx Harness	QC-C1500		MK
2	ElectroLynx Harness	QC-CXXP		MK
1	Power Supply	AQD Series		SU
2	DPS	By Security Contractor		OT

Notes: 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: 15.0
Description: Sgl - Int Alum-Vest - MELR Exit Device-NL - Closer w/Stop Arm - Access Control

2	Hinge (heavy weight)	T4A3786	US26D	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC*	US26D	MK
1	Rim Exit Device, Storeroom	55 56 70 8804 862	US32D	SA
1	Small Format Inter Core	33700006N P MK	26	MC
1	Door Closer	281 CPS	EN	SA
1	Kit	581-2	EN	SA
1	Mtg Plate	as required	EN	SA
1	ElectroLynx Harness	QC-C1500		MK
1	ElectroLynx Harness	QC-CXXP		MK
1	Power Supply	AQD Series		SU
1	DPS	By Security Contractor		OT
1	Card Reader	By security contractor		OT
1	Perimeter Seals	By the frame manufacturer		OT

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts latches on the exit devices for entry. Free egress at all times. Door status monitored.

Set: 22.0
Description: Single - SN200 Exit Device-NL - Closer - Access Control

2	Hinge (heavy weight)	T4A3786	US26D	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC*	US26D	MK

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1	Rim Exit Device	70 56-SN200-8804 BIPS-0E ETJ	US32D	SA
1	Small Format Inter Core	33700006N P MK	26	MC
1	Door Closer	281 Reg / PA / PS as required	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Gasketing	S88BL (head & jambs)		PE
1	ElectroLynx Harness	QC-C1500		MK
1	ElectroLynx Harness	QC-CXXP		MK
1	Power Supply	AQD Series		SU
1	DPS	By Security Contractor		OT

Set: 28.0
Description: Single - Storeroom

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LNJ	US26D	SA
1	Small Format Inter Core	33700006N P MK	26	MC
1	Door Stop	409 / 446 [as required]	US32D	RO
3	Silencer	608		RO

Set: 29.0
Description: Single - Storeroom - OH Stop

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LNJ	US26D	SA
1	Small Format Inter Core	33700006N P MK	26	MC
1	Surface Overhead Holder/Stop	10-x36	689	NO
3	Silencer	608		RO

Set: 34.0
Description: Single - SN200 Lock - Closer - gasket - DB - Sound

2	Hinge (heavy weight)	T4A3786	US26D	MK
1	Hinge, Full Mortise, Hvy Wt	T4A3786 QC*	US26D	MK
1	Access Control Mort Lock	70 SN200-82271-12V BIPS-0E LNJ	US26D	SA
1	Small Format Inter Core	33700006N P MK	26	MC
1	Door Closer	281 Reg / PA / PS as required	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 [as required]	US32D	RO
1	Gasketing	303AS		PE
1	Door Bottom	STC411APK		PE
1	ElectroLynx Harness	QC-C1500		MK
1	ElectroLynx Harness	QC-CXXP		MK
1	Power Supply	AQD Series		SU
1	DPS	By Security Contractor		OT

Notes: Notes: Doors are specified with additional gasketing for sound. These doors are not specified as true STC. 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: 38.0
Description: Single - Office

3	Hinge, Full Mortise	TA2714	US26D	MK

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1	Office/Entry Lock	70 8205 LNJ	US26D	SA
1	Small Format Inter Core	33700006N P MK	26	MC
1	Door Stop	409 / 446 [as required]	US32D	RO
3	Silencer	608		RO

Set: 39.0
Description: Single - Typical Classroom (storeroom)- Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LNJ	US26D	SA
1	Small Format Inter Core	33700006N P MK	26	MC
1	Door Closer	281 Reg / PA / PS as required	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 [as required]	US32D	RO
3	Silencer	608		RO

Notes: At aluminum frames, gasketing/silencer is by frame manufacturer.

END OF SECTION 080671

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SECTION 081213
HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal frames for non-hollow metal doors.

B. Fire-rated hollow metal frames for non-hollow metal doors.

C. Interior glazed borrowed lite frames.

1.02 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware: Hardware and silencers.

B. Section 088000 - Glazing: Glazed borrowed lites.

C. Section 099000 - Painting and Coating: Field painting of frames.

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. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

O. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - 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 grade standard.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

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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.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Frames with Integral Casings:
1. Amweld International: www.amweld.com
2. Ceco Door, Curries or Flem~~m~~ing, an Assa Abloy Group company: www.assaabloydss.com.
3. Deansteel Manufacturing: www.deansteel.com
4. De La Fontaine Industries Inc.: www.delafontaine.com.
5. Rocky Mountain Metals: rockymountainmetals.com.
6. Steelcraft, an Allegion brand: www.allegion.com/sle.
7. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Refer to Door and Frame Schedule on the drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.

B. Door Frame Type: Provide hollow metal door frames with integral casings.

C. Steel Sheet: Comply with one or more of the following requirements; galvannealed 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.

D. Accessibility: Comply with ICC A117.1, 2012 TAS and ADA Standards.

E. Break-form to profile free of warp, buckles and fractures with corners square and sharp. Form stop integral with frame except where detailed otherwise. Provide 3/4” stop height on all fire rated frames containing glazing when required by manufacturer’s fire listings. Dress sheared edges straight and smooth.

F. 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.

G. All frames shall be provided with floor clips spot welded to each jamb and punched for anchoring to the floor. All vertical mullions shall be supplied with U-shaped floor anchors that are to be anchored to the floor prior to setting frames.

H. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

I. 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 frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.

J. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

K. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

L. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.

M. All two-piece mullions shall be factory welded to form a single-piece, inseparable section before assembly into a frame unit.

N. Transom Bars: Fixed, of profile same as jamb and head.

O. Frames for Interior Glazing or Borrowed Lites: Construction and face dimensions to match door frames, and as indicated on drawings.

P. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

2.03 ACCESSORIES

A. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

B. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

D. 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.

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E. For each jamb in steel stud construction, provide 3 or more 18 gauge drywall type jamb anchors.

2.04 FINISHES

A. All frames shall be cleaned free from scale, rust or rough spots; shall be bonderized and shall receive one shop coat of, light gray, rust inhibitive primer before shipment. All touch-up on finished field painting shall be done be the painting contractor.

B. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

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 frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.

B. Where practicable, place frames prior to construction of enclosing walls and ceilings.

C. 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.

D. When installed in prepared openings in concrete construction, provide sealant between frame and concrete in accordance with provisions of Section 07 9200 – Joint Seal~~e~~ants of these Specifications.

E. Set frames accurately into position, plumbed, aligned, and braced securely until permanent anchors are set.

F. Coordinate frame anchor placement with wall construction.

G. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

H. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

I. Comply with glazing installation requirements of Section .

J. Install door hardware as specified in Section .

K. Coordinate installation of electrical connections to electrical hardware items.

L. Touch up damaged factory finishes.

3.04 ADJUST AND CLEAN

A. Final adjustment
   1. Check and readjust operating finish hardware items in hollow metal work just prior to final inspection.
   2. Leave work in complete and operating condition.
   3. Remove defective work and replace with work complying with the specified requirements.

B. Immediately after erection, sand smooth all rusted and damaged areas of prime coat, and apply touch-up of compatible air-drying primer.

3.05 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 edges, crossed corner to corner.

END OF SECTION

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SECTION 081416
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 081113 - Hollow Metal Doors and Frames.

C. Section 088000 - 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 013000 - 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)

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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 017800 - 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 016000 - Product Requirements.

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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 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:

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1. Transparent:
   a. See Section 01 6210 Schedule of Materials and Colors and Section 09 9000 Paintings and Coatings.

B. Finish doors in accordance with approved sample. Door color and finish shall be coordinated with the casework color and finish and approved by the Architect prior to fabrication.

C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

A. Hollow Metal Door Frames: See Section 081113.

B. Metal Louvers:
   1. Material and Finish: Roll formed steel; pre-painted finish to color as selected.

C. Glazing: See Section 088000.

D. Glazing Stops: Wood with metal clips for rated doors, 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

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SECTION 083100
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.02 RELATED REQUIREMENTS

A. Section 099000 - 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 013000 - 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. Panel 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.

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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. Panel 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. Panel Material: Aluminum extrusion with gypsum board inlay.
   2. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
   3. Size in Other Ceilings: 24 by 24 inch, unless otherwise indicated.
   4. 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. Panel 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.

2.02 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:
   1. ACUDOR Products Inc: www.acudor.com/#sle.
   2. Babcock-Davis: www.babcockdavis.com/sle.
   3. Best Access Doors: www.bestaccessdoors.com/#sle.
   4. Cendrex, Inc: www.cendrex.com/#sle.
   5. Elmdor: www.elmdor.com/#sle.
   6. MIFAB, Inc: www.mifab.com/#sle.
   7. Larsen's Manufacturing Company; www.larsensmfg.com.
   8. Nystrom, Inc: www.nystrom.com/sle.
   9. Substitutions: See Section 016000 - Product Requirements.

B. Provide ceiling access doors and panels at each interior suspended fan coil A/C Unit, plumbing valves, and other concealed mechanical or electrical equipment requiring access for service or maintenance as specified herein, and as needed for a complete and proper installation.

C. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Style: Exposed frame with door surface flush with frame surface.
      a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
      b. Plaster Mounting Criteria: Use plaster bead type frame.
   2. Door Style: Single thickness with rolled or turned in edges.
   3. Frames: 16-gauge, 0.0598-inch minimum thickness.

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4. Single Steel Sheet Door Panels: 16-gauge, 0,0625-inch minimum thickness.
5. Insulation: Non-combustible mineral wool or glass fiber.
6. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
   a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
   b. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
7. Stainless Steel Finish: No.4 brushed finish.
8. Steel Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
9. Size: As indicated.
10. Hardware:
    a. Hinge, Fire-Rated-Units: Continuous coil spring, self closing, self latching steel hinges with non-removable pin.
    b. Hinges for Non-Fire-Rated Units: Continuous spring steel hinges with removable pin..
    c. Handle: No handle.
    d. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.
    e. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.
    f. Inside Latch Release: Mechanism that allows door/panel to be opened from inside.
    g. Gasketing: Extruded neoprene, around perimeter of door panel.

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 unit door sills at exterior 8" above the finished surface to mitigate water intrusion.

C. Install frames plumb and level in openings, and secure units rigidly in place.

D. Position units to provide convenient access to concealed equipment when necessary.

E. Integrate access doors with the air barrier system.

END OF SECTION

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SECTION 084313
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 087100 - Door Hardware: Hardware items other than specified in this section.

B. Section 088000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA 501 - North American Fenestration Standard/Specification for windows, doors, and skylights; Current Addition.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

C. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2012.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

I. 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).

J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

K. 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).

L. 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.

M. 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.

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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 013000 - 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 017800 - 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. Basis of Design: Kawneer Company Inc; Trifab 601T Storefront System.
3. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
4. Vertical Mullion Dimensions: 2 inches wide by 6 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 016000 - Product Requirements.

2.02 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 016000 - Product Requirements.

2.03 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 color anodized.
a. Factory finish all surfaces that will be exposed in completed assemblies.

2. Finish Color: Refer to Section 01 6210-Schedule of Materials and Colors
3. 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.
4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
5. 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.
6. 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.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
9. 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.
10. 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. Interior Storefront, shall have adequate strength and stiffness to resist a minimum horizontal load of 5psf.
   a. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
5. 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.
6. 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.
7. Thermal Requirements:
   a. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180º 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.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system. All exterior locations, and where otherwise required, units must be thermally broken, with integral internal drainage systems.
   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.

B. Aluminum Subframing and Sill Receptors: Extruded aluminum, thermally broken to match framing members, at all exterior locations and where otherwise required, integrate with framing member drainage system.
   1. Finish: Same as storefront.
   2. Subframing: At perimeter of units, where required.
   3. Flat Fillers: Required at head and jamb exterior units wand where otherwise required.
   4. Sill Receptors: At sills at exterior units.

C. Glazing: As specified in Section 088000.

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.

2.05 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.
6. Cap seal all fasteners with compatible sealant at exterior locations and where otherwise required.

G. Exposed Flashings: See drawing details and Sectoin 07 6200-Sheet Metal Flashing and Trim; 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 088000.

N. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.06 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils thick.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 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.

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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 sill receptor 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".

2.08 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

3.01 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.

3.02 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 088000, using glazing method required to achieve performance criteria.

N. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 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.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general testing and inspection requirements.

B. Air/Water Leakage Testing: Provide testing per AAMA 502 at 10% of glazing area per building, to be performed at mockup, 35%, 50% and 90% 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% of glazing area per building, to be performed at mockup, 35%, 50% and 90% completion.

D. The Contractor is responsible for providing the Field Quality Control and testing as specified, unless otherwise noted. Testing must be performed by a qualified testing and inspection agency and must not self-performed. The Contractor is solely responsible for the cost, schedule, and associated rework if the building enclosure systems are not constructed in accordance with the Contract Documents or do not pass testing.

E. Failed tests are not accepted and require retesting until successful tests are achieved. The Contractor must implement repair(s) that are acceptable to the Architect and the Owner and retest the location to ensure the repair(s) is effective. If remedial repair(s) are not effective, the contractor must provide repairs and retest until the test results are satisfactory.

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3.05 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.

3.06 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.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 087100
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.

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 01 Section "General Conditions”.
2. Division 06 Section “Rough Carpentry”.
3. Division 06 Section “Finish Carpentry”.
4. Division 08 Section “Operations and Maintenance”.
5. Division 08 Section “Hollow Metal Doors and Frames”.
6. Division 08 Section “Flush Wood Doors”.
7. Division 08 Section “Wood Sliding Sound Control Door Assemblies.
8. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
9. Division 26 Section "Electrical”

D. Codes and References: Comply with the version 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 as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.

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5. ANSI/UL 437- Key Locks.

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.

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2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. 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.

E. 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.

1.4 CLOSEOUT SUBMITTALS

A. 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 Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 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. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door 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.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical 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.

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.

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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 indicating compliance with the referenced testing 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 according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

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, access control credentials, software 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".

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1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified 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 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.

1.8 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. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

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.

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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:

   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

   a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-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. Manufacturers:.

   a. Pemko (PE).

2.4 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges 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 with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

   a. McKinney (MK) - QC (# wires) Option.

B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with 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

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for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

   a. Pemko (PE) - SER-QC (# wires) Option.

C. 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 (MK) - Electrical Connecting Kit: QC-R001.
   b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

   a. McKinney (MK) - QC-C Series.

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. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. 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.
6. Keyway: Manufacturer’s Standard.

C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer’s United States patents.

1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.

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2. Manufacturers:

a. Medeco (MC) - X4.

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "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: Field verify and key cylinders to match Owner's existing system.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

G. Construction Keying: Provide temporary keyed construction cores.

H. 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.

2.6 KEY CONTROL

P. Electronic Key Management System: Provide an electronic key control system with Stand-alone Plug and Play features including advanced RFID technology. Touchscreen interface with PIN access for keys individually locked in place. Minimum 1,000 system users and 21 iFobs for locking receptors. System shall have a minimum 250,000 audit events screen displayed or ability to be exported via USB port.

1. Manufacturers:

a. Medeco (MC).

2.7 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - ML2000 Series.
b. Sargent Manufacturing (SA) - 8200 Series.

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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. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. 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. Exit devices shall have a five-year warranty.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

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8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Electromechanical exit devices shall have the following functions and features:

   a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
   b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
   c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
   d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
   e. Five-year limited warranty for electromechanical features.

2. Manufacturers:

   a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
   b. Sargent Manufacturing (SA) - 80 Series.

2.10 SURFACE 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.
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. 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 Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed 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

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body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Large body cast iron surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:

    a. Corbin Russwin Hardware (RU) - DC8000 Series.
    b. Norton Rixson (NO) - 9500 Series.
    c. Sargent Manufacturing (SA) - 281 Series.

2.11 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: ANSI A156.15, Grade 1 electromagnetic door holder/releases with a minimum 25 to 40 pounds holding power and fail-safe operation; power failure releases door to close.

1. Manufacturers:

    a. Norton Rixson (NO) - 900 Series.
    b. Sargent Manufacturing (SA) - 1560 Series.

2.12 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1” less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide protective trim with functions and features as follows:

    a. Meets ADA requirements for smooth bottom door surfaces.
    b. UL Classified options for use on fire-rated doors up to 3 hours.
    c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.
    d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.
    e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
    f. Fasteners included; adhesive-backed options available for select models.
    g. Ten-year limited warranty.

2. Manufacturers:

    a. Rockwood (RO).

2.13 DOOR STOPS AND HOLDERS

A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 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

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impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

   a. Rockwood (RO).

2.14 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 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.15 ELECTRONIC ACCESSORIES

A. Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Power supplies shall meet all functions and features as specified herein.

   a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
   b. Tolerates brownout or overvoltage input ± 15% of nominal voltage.
   c. Thermal shutdown protection with auto restart.
   d. Circuit breaker protection against overcurrent and reverse battery faults.
   e. Integrated battery charging circuit to prevent overvoltage on locking devices.

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f. Available with a single relay fire trigger or individually triggered relayed outputs.
g. Monitoring options as specified.

2. Manufacturers:

a. Securitron (SU) - AQD Series.

2.16 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.

2.17 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.

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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. DHI TDH-007-20: Installation Guide for Doors and Hardware.
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. 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.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

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.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

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.

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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

A. 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.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SA - SARGENT
4. MC - Medeco
5. RO - Rockwood
6. NO - Norton Rixson
7. OT - Other
8. SU - Securitron

Hardware Sets

Set: 1.0
Doors: D105, D109, D120

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Description: Pair - Exterior Alum -MELR Exit Device-NL/DT - Mullion - Closer w/Stop Arm - Access Control

2	Continuous Hinge	CFM SLF-HD1 SER*		PE
1	Removable Mullion	L980 (12-as req)	PC	SA
1	Exit Device (exit only)	55 8810 862	US32D	SA
1	Rim Exit Device, Storeroom	55 56 70 8804 862	US32D	SA
2	Small Format Inter Core	33700007N P MK (7-Pin)	26	MC
1	Cylinder - Mullion	70- 980C1	US26D	SA
2	Door Closer	281 CPS	EN	SA
2	Kit	581-2	EN	SA
2	Mtg Plate	as required	EN	SA
1	Astragal	By the door manufacturer		OT
2	Sweep	18061CNB x Dr. Width		PE
1	Panic Threshold	2005AT MSES25SS x Opening Width		PE
2	ElectroLynx Harness	QC-C1500		MK
2	ElectroLynx Harness	QC-CXXP		MK
1	Power Supply	AQD Series		SU
2	DPS	By Security Contractor		OT
1	Card Reader	By security contractor		OT
1	Perimeter Seals	By the frame manufacturer		OT

Notes: Operation: Doors normally closed and locked. Valid card at the card reader retracts latches on the exit devices for entry. Free egress at all times. Door status monitored.

Set: 2.0
Doors: D115, D119
Description: Pair INT - CLxCl - Mag HO

6	Hinge (heavy weight)	T4A3786	US26D	MK
2	Surface Vert Rod Exit, Classroom	12 70 NB-8713 ETJ	US32D	SA
2	Small Format Inter Core	33700007N P MK (7-Pin)	26	MC
2	Door Closer	281 Reg / PA / PS as required	EN	SA
2	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
2	Electromagnetic Holder	998M	689	NO
2	Door Stop	409 / 446 [as required]	US32D	RO
2	Astragal Set (2)	303AS		PE
1	Gasketing	2891AS (head & jambs)		PE

Set: 3.0
Doors: D126
Description: Single - Storeroom

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LNJ	US26D	SA
1	Small Format Inter Core	33700007N P MK (7-Pin)	26	MC
1	Door Stop	409 / 446 [as required]	US32D	RO
3	Silencer	608		RO

Set: 4.0
Doors: D116, D125
Description: Single - Storeroom Closer

3	Hinge, Full Mortise	TA2714	US26D	MK

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1	Storeroom/Closet Lock	70 8204 LNJ	US26D	SA
1	Small Format Inter Core	33700007N P MK (7-Pin)	26	MC
1	Door Closer	281 Reg / PA / PS as required	EN	SA
1	Door Stop	409 / 446 [as required]	US32D	RO
3	Silencer	608		RO

Set: 5.0
Doors: D121
Description: Single - Privacy Closer - Card Reader

1	Hinge, Full Mortise	TA2714 QC*	US26D	MK
2	Hinge, Full Mortise	TA2714	US26D	MK
1	Electrified Mortise Lock	70 PHR NAC-82281-24v LNJ	US32D	SA
1	Small Format Inter Core	33700007N P MK (7-Pin)	26	MC
1	Door Closer	281 Reg / PA / PS as required	EN	SA
1	Mop Plate	K1050 = 4" x 1" LDW CSK BEV	US32D	RO
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 [as required]	US32D	RO
3	Silencer	608		RO
1	ElectroLynx Harness	QC-C1500		MK
1	ElectroLynx Harness	QC-CXXP		MK
1	Power Supply	AQD Series		SU
1	DPS	By Security Contractor		OT
1	Card Reader	By security contractor		OT

Set: 6.0
Doors: D101, D102, D103, D104, D106, D107, D108, D110, D111, D112, D113, D114, D117, D118
Description: Single - Typical Classroom (storeroom)- Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	70 8204 LNJ	US26D	SA
1	Small Format Inter Core	33700007N P MK (7-Pin)	26	MC
1	Door Closer	281 Reg / PA / PS as required	EN	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 [as required]	US32D	RO
3	Silencer	608		RO

Set: 7.0
Doors: D122
Description: Single - Privacy - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Privacy Lock	V20 8265 LNJ	US26D	SA
1	Small Format Inter Core	3370000_N P MK	26	MC
1	Door Closer	281 Reg / PA / PS as required	EN	SA
1	Mop Plate	K1050 4" X 1" LDW 4BE CSK	US32D	RO
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 [as required]	US32D	RO
1	Gasketing	S88BL (head & jambs)		PE

Notes: At aluminum frames, gasketing/silencer is by frame manufacturer.

END OF SECTION 087100

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SECTION 088000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated glass units.

B. Glazing units.

C. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 081113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

C. Section 081416 - Flush Wood Doors: Glazed lites in doors.

D. Section 084313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

E. Section 084413 - Glazed Aluminum Curtain Walls: Glazing provided as part of wall assembly.

F. Section 088300 - Mirrors.

G. Section 088723 - Security Films.

H. Section 088813 - 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; 2024.

J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

K. FTD-SA - Filti Testing and Development Shooter Attack Certification.; Current Edition.

L. GANA (GM) - GANA Glazing Manual; 2008.

M. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

N. GANA (SM) - GANA Sealant Manual; 2008.

O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).

P. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.

Q. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

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R. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2026.

S. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

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 013000 - 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 014000 - 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 017800 - Closeout Submittals for additional warranty requirements.

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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 five (5) 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 016000 - 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 016000 - 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.

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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.

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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 #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. Forced Entry Resistance; Must comply with one of 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.
10. Wet Glaze Anchoring System: Structural Silicone Sealant/Adhesive.
    a. Dow Chemical Company; Dowsil 995 Silicone Structural Sealant: www.dow.com.

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; 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.

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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 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.

C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

D. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

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E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch below sight lines.
   1. Place glazing tape on glazing pane of unit with tape flush with sight line.

G. Fill gap between glazing and stop with manufactures recommended type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.

H. Apply cap bead of manufactures recommended type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.06 INSTALLATION - BUTT JOINT GLAZING METHOD (SEALANT ONLY)

A. Temporarily brace glass in position for duration of glazing process; mask edges of glass at adjoining glass edges and between glass edges and framing members.

B. Temporarily secure a small diameter nonadhering foamed rod on back side of joint.

C. Apply sealant to open side of joint in continuous operation; thoroughly fill joint without displacing foam rod, and then tool sealant surface smooth to concave profile.

D. Permit sealant to cure then remove foam backer rod, and then apply sealant to opposite side, tool smooth to concave profile.

E. Remove masking tape.

3.07 INSTALLATION - PRESSURE GLAZED SYSTEMS

A. Application - Exterior Glazed: Set glazing infills from exterior side of 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 pressure plates without displacing glazing gasket; exert pressure for full continuous contact.

E. Install cover plate.

3.08 INSTALLATION - STRUCTURAL SILICONE GLAZING

A. See Section 08 4313 for wall framing assembly requirements.

B. See Section 084413 for wall framing assembly requirements.

C. Application - Field Glazed: Follow basic guidelines of structural silicone glazing for glazing application.

D. Provide design review of the glazing system and project details, adhesion testing, proper surface preparation, training and a quality service program.

E. Provide only structural silicone sealant, tested and manufactured for structural glazing.

3.09 INSTALLATION - PLASTIC FILM

A. Install plastic film with adhesive, applied in accordance with film manufacturer's instructions.

B. Place without air bubbles, creases or visible distortion.

3.10 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.

3.11 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 088723
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 081113 - Hollow Metal Doors and Frames: New doors with glazing to receive film.

B. Section 08 4313-Aluminimum-Framed Storefronts: New glazing to receive film.

C. Section 084413 - Glazed Aluminum Curtain Walls: New glazing to receive film.

D. Section 088000 - Glazing: New glazing to received film.

1.03 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

B. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2014.

C. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.

E. FTD-SA - Filti Testing and Development Shooter Attack Certification.; Current Edition.

F. UL 972 - Standard for Burglary Resisting Glazing Material; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - 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.

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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 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide 10 year manufacturer's replacement warranty to cover film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. 3M Window Film: www.solutions.3m.com/#sle.

B. Armoured One: www.armouredone.com/#sle.

C. Madico, Inc: www.madico.com/#sle.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 SECURITY FILM

A. Security Film: Transparent polyester security film for permanent bonding to glass.
   1. Basis of Design: 3M, S140 transparent security film for permanent bonding to glass.
   2. Thickness: 0.014 inch, minimum.
   3. Color: Clear.
   4. Construction: Multi-ply laminate.
   5. Adhesive Type: Pressure sensitive acrylic.
   6. Tensile Strength: 25,000 psi minimum when tested in accordance with ASTM D882.
   7. Breaking Strength: 350 psi when tested in accordance with ASTM D882.
   8. Forced Entry Resistance; Must comply with one of 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. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84 (Class A).
   10. 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.

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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 that 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

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SECTION 088813
FIRE-RATED GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-rated glazing units.

B. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 081213 - Hollow Metal Frames: Glazed borrowed lites.

C. Section 081416 - 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. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

F. GANA (GM) - GANA Glazing Manual; 2008.

G. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

H. GANA (SM) - GANA Sealant Manual; 2008.

I. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2016).

K. ITS (DIR) - Directory of Listed Products; current edition.

L. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2017.

M. UL (DIR) - Online Certifications Directory; Current Edition.

N. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

O. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

P. UL 263 - Standard for Fire Tests of Building Construction and Materials; 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 013000 - 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.

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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 014000 - 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 017800 - 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.

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f. Substitutions: See Section 016000 - Product Requirements.

2.02 GLAZING UNITS

A. Type GFRR - Glass Fire-Resistance-Rated: Type, thickness, and configuration of glazing that contains flames, smoke, and blocks radiant heat, as required to achieve indicated fire rating period exceeding 45 minutes.
   1. Applications:
      a. Glazing in fire-rated door assembly.
      b. Glazing in fire-rated window assembly.
      c. Glazing in sidelites, borrowed lites, and other glazed openings in fire-rated wall assemblies.
      d. 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-Resistance-Rated Glazing Assemblies: Provide permanent markings on fire-resistance-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction.
      a. "W" - meets wall assembly criteria of ASTM E119 or UL 263 fire test standards.
      b. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
      c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire test standards.
      d. 'T' - meets temperature rise of not more than 450 degrees F above ambient at end of 30 minutes fire exposure in accordance with NFPA 252, UL 10B, or UL 10C fire test standards.
      e. "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 017000 - 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 090561
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving floor coverings.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.

F. Patching compound.

G. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements: Additional requirements relating to testing agencies and testing.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete; 2020.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2017.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.

D. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.

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6. Product data for recommended remedial coating.
7. Submit report to Architect.
8. Submit report not more than two business days after conclusion of testing.

E. Adhesive Bond and Compatibility Test Report.

F. Copy of RFCI (RWP).

G. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
1. Manufacturer's qualification statement.
2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
4. Manufacturer's installation instructions.
5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

1.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

D. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

E. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

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PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
   2. Products:
      a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com.
      b. Floor Seal Technology, Inc; MES 100: www.floorseal.com.
      c. Koster American Corporation; Koster VAP 1 2000: www.kosterusa.com.
      d. LATICRETE International, Inc; LATICRETE NXT Vapor Reduction Coating with LATICRETE NXT Level Plus: www.laticrete.com/#sle.
      e. TEC, an H.B. Fuller Construction Products Brand; TEC LiquiDam EZ with TEC Level Set 200 SLU: www.tecspecialty.com.
      f. UZIN, a division of UFLOOR Systems Inc; UZIN PE 460: www.ufloorsystems.com.
      g. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
      a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
      b. Removal of existing floor covering.
   2. Preliminary cleaning.
   3. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
   4. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   5. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   6. Specified remediation, if required.
   7. Patching, smoothing, and leveling, as required.
   8. Other preparation specified.
   9. Adhesive bond and compatibility test.
   10. Protection.

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3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Test in accordance with ASTM F1869 and as follows.

C. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

D. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

E. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Test in accordance with ASTM F2170 Procedure A and as follows.

C. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

D. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

E. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

3.07 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.10 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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SECTION 092116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Gypsum wallboard.

C. Joint treatment and accessories.

D. Textured finish system.

E. Non-textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 072100 - Thermal Insulation: Acoustic insulation.

D. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

E. Section 079200 - 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 (Reapproved 2022).

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 C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.

I. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018 (Reapproved 2023).

J. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

K. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.

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.

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P. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

Q. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2025.

1.04 SUBMITTALS

A. See Section 013000 - 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 40ºF.
4. For adhesive attachment of gypsum board, and for finishing of gypsum board, maintain ambient temperature above 55ºF 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 054000.

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 016000 - 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.
   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 Drywall: www.certainteed.com/#sle.
      b. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
      c. National Gypsum Company; Gold Bond BRAND Fire-Shield Type X Gypsum Board: www.nationalgypsum.com/#sle.
      d. USG Corporation; USG Sheetrock Brand Firecode X Panels: www.usg.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.

C. Impact Resistant Wallboard:
   1. Application: Vandal or destructive resistance areas indicated.
   2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.

5. Hard Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
7. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
8. Type: Fire-resistance-rated Type X, UL or WH listed.
9. Thickness: 5/8 inch.
10. Edges: Tapered.
11. Paper-Faced Products:
    a. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech: www.certainteed.com/#sle.
    b. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board: www.nationalgypsum.com/#sle.
    c. USG Corporation; USG Sheetrock Brand Mold Tough VHI Firecode X Panels: www.usg.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

D. 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 016000 - Product Requirements.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: As specified in Section 072100.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. 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.

D. 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 016000 - Product Requirements.

E. 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.

F. Finishing Compound: Surface coat and primer, takes the place of skim coating.

G. Textured Finish Materials: Latex- or Vinyl-based compound; plain.

H. 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.

I. 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.

J. 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.

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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 .
   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 ½”. 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 and ceilings as shown on the drawings but in no case shall they exceed 30”-0” on center or as indicated on the drawing. Contractor shall be responsible to ensure 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, window, and all framed openings from head of door to 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 NON-TEXTURED FINISH

A. Finish all exposed gypsum board walls and ceilings to Level 4 in accordance with GA-214 and ASTM C840 to recieve a painted, non-textured finish unless otherwise indicated on the drawings.

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 092226
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:

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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 016000 - 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

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SECTION 092236
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 054000 - Cold-Formed Metal Framing: Sheathing on exterior walls.

B. Section 072500 - Weather Barriers: Weather barrier under exterior plaster and stucco.

C. Section 092400 - 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 C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2019a.

D. 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 013000 - 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.

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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 applicationcomply 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 083100.

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.

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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

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SECTION 092400
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 054000 - Cold-Formed Metal Framing: Structural metal framing for plaster.

B. Section 061000 - Rough Carpentry: Wood stud framing for plaster.

C. Section 092236.23 - 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 013000 - 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.

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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 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide a warrantable assembly.

C. Correct defective Work within a one 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. 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 016000 - 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 092236.23.

B. Beads, Screeds, and Joint Accessories: In accordance with ASTM C1063 and as specified in Section 092236.23.

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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.

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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 suffcient 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.

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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

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SECTION 093000
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 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

D. Section 079513 - Expansion Joint Cover Assemblies: Expansion joint components.

E. Section 092116 - 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 013000 - 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 016000 - 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.

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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 014000 - 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 that 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 017800 - 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. Arizona Tile: www.arizonatile.com.
   3. Concept Surfaces: www.conceptsurfaces.com.
   4. Crossville Inc.: www.crossvilleinc.com.
   5. Dal-Tile Corporation: www.daltile.com/#sle.
   6. Emser Tile, LLC: www.emser.com/#sle.
   7. Horizon Italian Tile: www.horizontile.com.
   8. Pantheon: pantheontile.com.
   9. Emser Tile Company: www.emser.com.
   10. Substitutions: See Section 016000 - Product Requirements.

B. Ceramic Tile: ANSI A137.1, standard grade.

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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 - QUADEC.
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 availible.
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.

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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 016000 - 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 016000 - 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 016000 - 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.

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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 016000 - 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 016000 - 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 016000 - Product Requirements.

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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.

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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 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

END OF SECTION

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SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Suspended metal open grid ceiling system.

C. Decorative Grid System Trim

D. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 053100 - Steel Decking: Placement of special anchors or inserts for suspension system.

B. Section 072100 - Thermal Insulation: Acoustical insulation.

C. Section 083100 - 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 013000 - 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.

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1. See Section 016000 - 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 017800 - 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.

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3. Rockfon, LLC[: www.rockfon.com/#sle.
4. USG: www.usg.com.
5. Substitutions: See Section 016000 - Product Requirements.

B. Suspension Systems:
1. Same as for acoustical units.
2. Substitutions: See Section 016000 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. Acoustical Tile Type L1 - Standard Panel: 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: Fine Fissured 1728 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 016000 - 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 016000 - Product Requirements.

C. Open Grid System

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1. Components: All main beams and cross tees shall be commercial-quality galvanized steel coating as per ASTM A 653. Exposed surfaces chemically cleansed, capping pre-finished galvanized steel. Main beams and cross tees are double-web steel construction and have a 15/16" type exposed flange design. Cross tees shall have staked-on end detail allowing for easy cross tee removal and remounting.
   a. Structural Classification: ASTM C635 heavy duty.
   b. Color: Custom match to paint colors. Reference Section 01 6210 - Schedule of Colors for approved color selections.
   c. Prelude XL 360° Painted Grid, as manufactured by Armstrong.
2. Finish: All steel roll-formed parts shall be chemically cleansed hot dipped galvanized steel. Main beams and cross tees shall be painted 360° and prefinished in baked polyester paint.
3. Attachment Devices: Size for five times design load indicated in ASTM C635, Table 1, Direct Hung unless otherwise indicated.
4. Wire for Hanger and Ties: ASTM A 641, Class 1 zinc coating, soft temper, prestretched, with a yield stress load of at least three times design load, but not less than 12 gauge.
5. Products:
   a. Basis of Design for Open Grid System: "Prelude XL 360° Painted Grid" 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. Ceiling Tile and Grid shall be of the same manufacturer.
   c. Substitutions: See Section 016000 - 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 016000 - 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.

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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.

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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 096500
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 033000 - 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 013000 - 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 016000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 2% of each type and color.
   3. Extra Wall Base: 2% of each type and color.
   4. Extra Stair Materials: Quantity equivalent to 2% of each type and color.

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.

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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 017800 - 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. Warranty Period: One (1) year 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. Armstrong World Industries, Inc: www.armstrong.com.
      b. Azrock: www.azrock.com.
      c. Flexco, Inc: www.flexcofloors.com.
      d. Johnsonite, a Tarkett Company: www.johnsonite.com.
      e. Tarkett Commercial: www.commercial.tarkett.com.
      f. Mannington Mills, Inc: www.mannington.com.
      g. Patcraft: www.patcraft.com.
      h. Substitutions: See Section 016000 - 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 016000 - 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: 5 inch.
   4. Thickness: 0.125 inch.
   5. Length: Roll.
   6. Color: Refer to Section 01 6210 Schedule of Materials and Colors.
   7. Accessories: Premolded external corners where return is 3" or less.

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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.
   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 reccommended by the manufacturer.

D. Moldings, Transition and Edge Strips: Metal.

E. Sealer and Wax: Types recommended by flooring manufacturer.

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 inluding kitchens, food storage, serving lines, etc. Color as selected by Architect.

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3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean, seal, and wax 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 096816
SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Entrance Walk-Off Carpeting.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied carpet.

1.03 REFERENCE STANDARDS

A. CRI 104 - Standard for Installation of Commercial Carpet; 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings.

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.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional requirements.
   2. Extra Carpet: Quantity equal to 5 percent of total installed of each color and pattern installed.

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 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.

1.07 WARRANTY

A. See Section 017800 - 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.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Walk-Off Carpeting:
   1. Interface, Inc: www.interfaceinc.com.
   2. Mats, Inc: www.matsinc.com.
   3. Patcraft: www.patcraft.com.
   4. Tandus Centiva: www.tandus-centiva.com.
   5. Tarkett Commercial: www.commercial.tarkett.com.

2.02 CARPET

A. Walk-Off Sheet Carpeting:
   1. Basis of Design - Product: Abrasive Action II 02578 Powerbond Cushion as manufactured by Tarkett Commercial.
   2. Roll Width: 6 foot, nominal.
   3. Roll Length: 105 foot, nominal.
   4. Thickness: 0.115 inch.
   5. Pile Yarn Composition: 100 % Solution-Dyed Low Static Polypropylene.
   6. Primary Backing: Synthetic non-woven.
   7. Color: As indicated in the drawings.
   8. Product shall be wall to wall over a full-spread adhesive.

2.03 ACCESSORIES

A. Sub-Floor Filler: Type recommended by carpet manufacturer.

B. 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.

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. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Install carpet and cushion in accordance with manufacturer's instructionsand CRI 104 (Commercial).

B. Verify carpet match before cutting to ensure minimal variation between dye lots.

C. Lay out carpet and locate seams in accordance with shop drawings.

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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.

D. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 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.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

END OF SECTION

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SECTION 099000
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.

1.02 RELATED SECTIONS

A. Section 05 2100 - Steel Joist Framing: Shop priming

B. Section 05 5000 - Metal Fabrications: Shop priming

C. Section 06 2000 - Finish Carpentry: Back priming of trim and paneling

D. Section 07 8123 - Intumescent Fire Protection: Field-applied paints coordination with intumescent fireproofing substrate.

E. Division 23 - Mechanical Identification: Markers and color-coding

F. Division 26 - Electrical Identification: Markers and color-coding

1.03 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.

1.04 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.

1.05 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.

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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.

1.06 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.

1.07 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.

1.08 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.

1.09 MAINTENANCE

A. Extra Materials
   1. At completion of project, deliver to Owner extra stock of materials used on project as follows:
      a. High School - Twenty (20) gallons for each field color/type, five (5) gallons for trim and accent of each color/type.
      b. Junior High/Middle School - Fifteen (15) gallons for each field color/type, four (4) gallons for trim and accent of each color/type.
      c. Elementary/Intermediate School - Ten (10) gallons for each field color/type, three (3) gallons for trim and accent of each color/type.
      d. Additions and Renovations - Five (5) gallons for each field color/type, two (2) gallons for trim and accent of each color/type.

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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. PPG Paints: www.ppgpaints.com

D. Benjamin Moore & Co.: www.benjaminmoore.com.

E. 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.

C. Compatibility with other materials:
1. Topcoats: Suitable for application over applied intumescent coatings; of type recommended in writing by intumescent coatings manufacturer for each fire resistance design. Topcoat to have been tested by manufacturer for compatibility in fire conditions with documentation of such tests to be provided upon request. Color of topcoat shall be as selected by the architect. Colors shall not be limited to manufacturer's standard colors.
2. See Section 07 8123 - Intumescent Fire Protection for additional information.

2.03 COLOR SCHEDULES

A. See color schedule on the drawings and 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.

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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 or Aluminum Metal including Ductwork
      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.
      b. Test surfaces with Passivator Test Kit to ensure that the surface is ready for paint.

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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.

E. Apply coatings using methods recommended by manufacturer.

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F. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

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. 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.

J. At gymnasiums, contractor shall paint wood blocking for gym equipment supports to match adjacent color. Contractor shall coordinate the sequencing with all trades.

K. 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.

L. Miscellaneous surfaces and procedures
   1. Exposed mechanical items
      a. Finish electric panels, access doors, exposed conduits, exposed pipes, ducts, grilles, registers, vents, and items of similar nature to match the adjacent wall and ceiling surfaces as scheduled.
      b. Paint visible duct surfaces behind vents, registers, and grilles as scheduled.
   2. Hardware: Paint prime coated hardware to match adjacent surfaces.
   3. Wet areas
      a. In toilet rooms and contiguous areas, add an approved fungicide to paints.
   4. Exposed vents: Apply two coats of heat-resistant paint approved by the Architect.

M. Inspection: The coated surface must be inspected and approved by the architect just prior to each coat.

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.

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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, B28W12600.
      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, B28W12600.
      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.

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.

3.06 PAINTING SCHEDULE

A. The Painting Schedule of this Section is based, in general, on products of Sherwin-Williams Company (noted SW on the schedule).

B. 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.

C. Code 100a - Exterior Metal
   1. Including flashing, vents, doors, window trim and grilles, aluminum, and galvanized metal
   2. 1st Coat: SW Pro Industrial ProCryl Universal Primer, B66-1300 Series.
   3. 2nd/3rd Coat: W Pro Industrial Acrylic Semi-Gloss, B66-650 Series.

D. Code 100b - Exterior Metal
   1. For use on exterior painted handrails and exposed structural steel over properly prepared steel (SSPC SP-6 Commercial Metal Blast, 2-3 mil profile).
   2. 1st Coat: SW Macropoxy 646 FC Epoxy B58 Series.
   3. 2nd/3rd Coat: Sher-Loxane 800 Two Component Polysiloxane Semi-Gloss or Gloss finish.

E. Code 101 - Exterior Wood
   1. Including wood doors, screens and trim
   2. 1st Coat: SW Exterior Latex Waterbased Wood Primer, B42W8141.
   3. 2nd/3rd Coat: A-100 Exterior Acrylic Satin, A82 Series.

F. Code 102 - Exterior CMU
   1. 1st Coat: SW PrepRite Block Filler, B25W25.
   2. 2nd/3rd Coat: SW A-100 Exterior Acrylic Satin, A82 Series

G. Code 103a - Interior Wood (Natural Wood)
   1. 1st/2nd/3rd Coat: SW Gallery Series Waterborne Topcoat, 20 Gloss, B52F00020 Satin (Clear) – *spray application*

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H. Code 103b - Interior Wood (Stain & Finish)
   1. 1st Coat: SW Sher-Wood Wiping Stain, S64 series. (color as selected by Architect)
   2. 2nd/3rd Coat: SW Gallery Series Waterborne Topcoat, 20 Gloss, B52F00020 Satin (Clear) – *spray application.*

I. Code 103c - Interior Wood (Painted Surface, Enamel):
   1. 1st Coat: SW Premium Wall & Wood Primer, B28W8111.
   2. 2nd/3rd Coat: SW Pro Industrial Waterbased Alkyd Urethane Enamel, Semi-Gloss, B53-2150/5150 series.

J. Code 104a - Interior Metal (Painted Surface, Enamel)
   1. 1st Coat: ProCryl Universal Primer, B66-1300 series.
   2. 2nd/3rd Coat: SW Pro Industrial Waterbased Alkyd Urethane Enamel Semi-Gloss, B53-2150-5150 series.

K. Code 104b - Interior Metal (Aluminum or Galvanized Duct Work and Accessories.)
   1. Surface Preparation: See Article 3.02, E, 4.
   2. 1st/2nd Coat: S-W Pro Industrial Waterborne Acrylic Dryfall, B42 Series.

L. Code 104c - Interior Metal, "Wet/Shower" Areas, Vehicle Wash Bays, Natatoriums (Painted Surface, Epoxy)
   1. Surface Preparation: SSPC-SP 6/NACE 3.
   2. 1st Coat: SW, Series, B65G10, Corothane I Galvapac 2K Zinc Primer, DFT 3.0-4.0 mils
   3. 2nd Coat: SW, Series B58-600, Macropoxy 646 Fast Cure Epoxy, DFT 5.0-10.0 mils
   4. 3rd Coat: SW, Sher-Loxane 800, Two Component Polysiloxane, DFT 4.0-6.0 mils.
   5. Total DFT 12-20 mils.

M. Code 104d - Exposed Structural Steel and Deck for Ceilings
   1. Touch-up factory prime coat on ferrous steel with SW Pro Induatrial ProCryl Universal Primer, B66-1300 Series.
   2. 1st /2nd Coat: SW Pro Industrial Waterborne Acrylic DryFall Flat, B42 Series.

N. Code 104e - Exposed Structural Steel, Joist and Deck in Crawl Space
   1. Surface Preparation: SSPC SP-6 Commercial Metal Blast, 2-3 mil profile.
   2. 1st Coat: SW, Zinc Clad 4100 applied at 3-5 mils dry film thickness.

O. Code 105a - Interior Masonry (Typical)
   1. 1st Coat: SW Loxon Concrete & Masonry Primer-Sealer, LX2W50.
   2. 2nd/3rd Coat: SW ProMar 200 Zero VOC Interior Latex Eg-Shel, B20 Series.

P. Code 105b - Interior Masonry (Sound Rated Partitions)
   1. 1st/2nd Coat: SW Loxon Concrete & Masonry Primer, LX2W50.
   2. 3rd/4th Coat: SW Pro Mar 200 Zero VOC Latex Semi-gloss, B31 Series.

Q. Code 105c - Two Component Epoxy Coating for CMU Walls (Foodservice Areas)
   1. 1st Coat: SW Pro Industrial Heavy Duty Block Filler, B42W150. This material is to be applied at the rate of 75sq. ft. per gallon or until surface is filled free from any voids or holes. Surface is to be filled free from excess mortar and cracks.
   2. 2nd/3rd Coat: SW Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series.

R. Code 105d - Two Component Epoxy Coating for CMU Walls ("Wet/Shower" Areas, Vehicle Wash Bays, Natatoriums)
   1. 1st Coat: SW Kem Cati-Coat HS Epoxy Filler/Sealer, B42W400.
   2. 2nd Coat: SW, Series B58-600, Macropoxy 646 Fast Cure Epoxy, DFT 5.0-10.0 mils.
   3. 3rd Coat: SW, Sher-Loxane 800, Two Component Polysiloxane, DFT 4.0-6.0 mils.
   4. Total DFT 12-20 mils.

S. Code 106a - Interior Drywall (Walls; Typical)
   1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W12600.

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2. 2nd/3rd Coat: SW Pro Mar 200 Zero VOC Latex Eg-Shel, B20 Series.

T. Code 106b - Interior Drywall (Walls; Multi-User Restrooms, Janitor and Mechanical Rooms)
   1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W12600.
   2. 2nd/3rd Coat: SW Pro Mar 200 Zero VOC Latex Semi-gloss, B31 Series.

U. Code 106c - Interior Drywall (Ceilings)
   1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W12600.
   2. 2nd/3rd Coat: SW ProMar 200 Zero VOC Interior Latex Flat, B30-Series.

V. Code 106d - Interior Non-Textured Drywall (where painted or applied graphics occur)
   1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W2600.
   2. 2nd/3rd Coat: SW Cashmere Interior Acrylic Latex DP-D17W00151.

W. Code 106d - Two Component Epoxy Coating for Gyp Board Walls (Foodservice Areas)
   1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W12600.
   2. 2nd/3rd Coat: SW Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series.

X. Code 107a - Two Component Epoxy Coating (Floors)
   1. 1st Coat: SW ArmorSeal 33 Epoxy Primer/Sealer, B58 series.
   2. 2nd/3rd Coat: SW ArmorSeal 1000 HS, B67-2000 Series
   3. At locker rooms and wet or damp areas provide anti-slip agent equal to one of the following:
      a. H&C Concrete Products, Sharkgrip Slip Resistant Additive
      b. QC Construction products, QC Sure Trac

Y. Code 107b - Concrete Floor Sealer
   1. Properly clean surface as per manufacturer's recommendations.
   2. 1st/2nd Coat: BASF MasterKure CC 250 SB (Formerly Kure-N-Seal)
   3. At locker rooms and wet or damp areas provide anti-slip agent equal to one of the following:
      a. H&C Concrete Products, Sharkgrip Slip Resistant Additive
      b. QC Construction products, QC Sure Trac

Z. Code 108 - Interior Tectum Panels (Maintaining Acoustic Properties)
   1. 1st Coat: Pro Coat ProCoustic Acoustical Tile and Ceiling Coating.
   2. 2nd Coat (as needed): Same as first coat.

AA. Code 109 - Green Screen Paint
   1. 1st Coat: SW ProMar 200 Zero VOC Interior Latex Primer, B28W12600.
   2. 2nd/3rd Coat: Water Based Acrylic Chroma Key Matte Green Video Paint.

END OF SECTION

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SECTION 101100
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 061000 - 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 013000 - 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 017800 - 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 016000 - 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.

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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.

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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

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SECTION 101400
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 013000 - 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.

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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 016000 - 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. Sign Type: Flat signs with extruded acrylic panel media as specified.
2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
3. Basis of Design: Match Existing.
4. All letters, numbers and/or symbols shall contrast with their background. Characters and background shall have a non-glare finish.
5. Background color as selected by architect from manufacturer’s actual color samples.
6. Letterform shall be Helvetica Regular upper case letters and numbers.
7. 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 6".
   e. Standard Grade 2 braille shall be ½" below copy.

f. Corners: Square edges.

8. Provide solid cover plate for back side of sign where mounted to glass.
9. 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.
10. 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 have 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. 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.
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

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5) Activity Room

d. Provide "Exterior Room Identification Signage" at all exterior mechanical, electrical and fire riser rooms.

3. Type C - Restroom signs with accessibility and gender symbol with the verbal description placed directly below and followed by Grade 2 braille.
4. Type D - Pictogram signs with 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 102113.19
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.

B. Section 055000 - Metal Fabrications: Concealed steel support members.

C. Section 061000 - Rough Carpentry: Blocking and supports.

1.03 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.

D. Color charts showing colors available from the proposed manufacturer in the specified products.

E. Samples: Submit two samples of partition panels, 6 by 6 inch in size illustrating panel finish, color, and sheen.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.06 WARRANTY

A. Provide fifteen year manufacturer warranty against plastic breakage, corrosion, and delamination.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Toilet and Shower Compartments:
   1. ASI Accurate Partitions: www.asi-accuratepartitions.com/#sle.
   2. ASI Global Partitions: www.asi-globalpartitions.com/#sle.
   3. Hadrian: www.hadrian-inc.com/#sle.
   4. Partition Systems International of South Carolina: www.psisc.com/#sle.
   5. Scranton Products: www.scrantonproducts.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

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2.02 PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted headrail-braced.
   1. Color: As scheduled in Section 01 6210 - Schedule of Materials and Colors.

B. Doors:
   1. Thickness: 1 inch.
   2. Width: 28 inch.
   3. Width for Accessible Use: 36 inch, out-swinging. (minimum)
   4. Width for Ambulatory Use: 34 inch, out-swinging.
   5. Height: 55 inch.

C. Panels:
   1. Thickness: 1 inch.
   2. Height: 55 inch, mounted 14" above the finished floor.
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 1 inch.
   2. Width: As required to fit space; minimum 3 inch.

E. Screens: Without doors; to match compartments; mounted to wall with continuous panel brackets with vertical support/bracing same as compartments.

F. Shower Cubicles shall be 1" thick with all edges rounded to a 1/4" radius. Standard vanity size is 24" wide by customer specified length not to exceed 120" for a single piece.

2.03 ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor and ceiling fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
   2. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.

B. Wall, Pilaster, and Shower Brackets: Stainless steel; continuous type.

C. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

D. Hinges: Stainless steel, manufacturer's standard finish.
   1. Continuous-type hinge, self closing.

E. Door Hardware: Stainless steel, manufacturer's standard finish.
   1. Door Latch: Slide type with exterior emergency access feature.
   2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
   3. Provide door pull for outswinging doors.

F. Coat Hook with Rubber Bumper: One per compartment, mounted on door.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 1/4 inch to 3/8 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

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SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Under-lavatory pipe supply covers.

1.02 RELATED REQUIREMENTS

A. Section 06 1000-Rough Carpentry: Concealed supports for accessories, including in wall framing and plates and above ceiling framing.

B. Section 102113.19 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

F. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017.

G. ASTM C1036 - Standard Specification for Flat Glass; 2021.

H. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

I. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023.

K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015 (Reapproved 2021)e1.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

B. Provide accessories for Integrated Room Mock-ups as required in Section 01 4000-Quality Requirements.

C. Review delivery dates for Owner-Furnished products.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

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3. Include electrical characteristics.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify accessories using designations indicated.

D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

E. Closeout Submittals:
   1. Submit under provisions of Section 01 7800 Closeout Submittals.
   2. Maintenance Data: For accessories to include in maintenance manuals.

1.06 WARRANTY

A. Manufacturer’s Special Warranty: Manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period.
   1. All accessories not specifically listed otherwise, (1) year from date of Substantial Completion.
   2. Mirrors: Failures include, but are not limited to, visible silver spoilage defects; warranty period (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. Basis of Design: Model numbers listed are per Bradley Corporation unless noted otherwise.
   2. ASI - American Specialties, Inc: www.americanspecialties.com/#sle.
   3. Bobrick Washroom Equipment, Inc.: www.bobrick.com.
   4. Bradley Corporation: www.bradleycorp.com/#sle.
   5. GAMCO – (General Accessory Mfg. Co): www.gamcousa.com.
   6. Georgia-Pacific Professional: www.blue-connect.com/#sle.
   7. Kimberly Clarke Professional: www.kcprofessional.com.
   8. Substitutions: Section 016000 - Product Requirements.

B. Under-Lavatory Pipe Supply Covers:
   1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
   2. Substitutions: Section 016000 - Product Requirements.

C. Source Limitations: Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide four keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666/A666M, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

G. Adhesive: Two component epoxy type, waterproof.

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H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof.

I. Expansion Shields: Fiber or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.

C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

D. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

E. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser, (**T1**): Double roll, surface mounted bracket type, stainless steel with hinged door, non-removable spindles, and tumbler lock designed to prevent theft of tissue roll.
   1. Mounting: Partition mounted, serving two adjacent toilet compartments or surface mounted; refer to drawings.
   2. Products:
      a. Basis of Design: Model 5422, dual roll, partition mounted, serves two compartments.
      b. Basis of Design: Model 5402, dual roll, surface mounted.

B. Toilet Paper Dispenser, (**T1A**): Double roll, side-by-side, surface mounted.
   1. Diecast aluminum bracket with satin finish.
   2. Holds two standard core toilet tissue rolls.
   3. Non-controlled paper delivery.
   4. Products:
      a. Basis of Design: Model 5241-50.

C. Paper Towel Dispenser, (**T6**): Electric, roll paper type.
   1. Cover: Translucent high impact plastic.
   2. Paper Discharge: Automatic motion sensing mechanism with user-adjustable delay and paper towel length.
   3. Capacity: 8 inch diameter roll.
   4. Mounting: Surface mounted.
   5. Power: Battery operated.
   6. Refill Indicator: Transparent viewing slot.
   7. Products:
      a. Basis of Design: Model 2494.

D. Soap Dispenser, (**T11**): Liquid soap dispenser, wall-mounted, surface, with stainless steel cover; push type soap valve, check valve, and window gauge refill indicator.
   1. Minimum Capacity: 48 ounces.
   2. Products:
      a. Basis of Design: Model 6562, liquid soap dispenser.

E. Mirrors: Stainless steel framed, (**T9**) and (**T10**): 1/4 inch thick annealed float glass; ASTM C1036.
   1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
   2. Frame: 0.05 inchangle shapes, with mitered and welded and ground corners; satin finish.
   3. Back of unit shall be galvanized steel, secure to frame with concealed screws, equipped with integral horizontal hanging brackets and separate wall hanger for concealed mounting.
   4. Products:

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a. Basis of Design: (**T9**), Model 780-1836, single lavatory mirror, 18” x 36”.
b. Basis of Design: (**T10**), Model 780-2460, full-length mirror, 24” x 60”.

F. Grab Bars, (**T4**) and (**T5**): Stainless steel, textured surface.
1. Heavy Duty Grab Bars:
a. Push/Pull Point Load: 250 pound-force, minimum.
b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
c. Finish: Satin.
d. Length and Configuration: As indicated on drawings.
e. Mounting: Flanges with concealed fasteners.
f. Products:
1) Basis of Design: (**T5**), Model 8122-00118, 18 inch vertical grab bar.
2) Basis of Design: (**T4**), Model 8122-00136, 36 inch grab bar.
3) Basis of Design: (**T5)**, Model 8122-00142, 42 inch grab bar.

G. Sanitary Napkin Disposal Unit, (**T2**): Stainless steel, with self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Mounting: Partition mounted, dual access or surface mounted; refer to drawings.
2. Products:
a. Basis of Design: Model 4721-15, partition mounted, serves two compartments.
b. Basis of Design: Model 4722-15, surface mounted.

H. Single Robe Hook (**T13**): Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.
1. Products:
a. Basis of Design: Model 9114.

2.05 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers (**T23**):
1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with TAS/ADA Standards.
2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
3. Construction: 1/8 inch flexible PVC.
a. 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. Comply with ASTM C1822, type indicated.
c. Microbial and Fungal Resistance: Comply with ASTM G21.
4. Color: White.
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
6. Products:
a. Basis of Design: Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: www.plumberex.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06 1000-Rough Carpentry for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

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B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

D. Locate accessories in order that they do not interfere with door swings or use of fixtures. Install recessed accessories after wall finishes have been completed.

E. Anchor accessories with bolts, plates, and approved type fasteners. Take down any loose items and repair damaged wall surfaces. Accessories anchored to toilet partitions shall be thru-bolted.

F. Mount surface mounted accessories to backup material with toggle bolts, plumb and align.

G. At metal stud partitions, provide fire-retardant treated wood blocking for anchorage of grab bars, wall-mounted seats and benches, baby changing stations, and other such wall-mounted accessories where additional loads are anticipated.
   1. For accessories protruding 3-inches or less from the wall, Contractor may utilitize ClarkDietrich Danback Flexible Wood Backing System with FlamePRO fire-retardant treated wood.

H. At recessed electric hand dryers located in metal stud wall partitions, install rigid sound insulation in wall around unit.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

3.05 SCHEDULE

A. Provide the following accessories at type of room scheduled, whether indicated on the drawings or not. Refer to drawings for configuration and mounting heights. Provide (1) of each per accessory listed unless otherwise noted or designated as Owner-furnished.

B. Type C – Toilet Compartments
   1. Type C1 Standard Compartment:
      a. T1 Toilet Tissue (Roll) Dispenser.
      b. T2 Sanitary Napkin Disposal (at designated female restrooms, grades 6 to adult only).
   2. Type C2, C3 and C5 Accessible Compartments:
      a. T1 Toilet Tissue (Roll) Dispenser
      b. T2 Sanitary Napkin Disposal (at designated female restrooms, grades 6 to adult only).
      c. T5 Grab Bars, 18 inch, vertical.
      d. T4 Grab Bars, 36 inch.
      e. T5 Grab Bars, 42 inch.
   3. Type C4 Ambulatory Accessible Compartment:
      a. T1 Toilet Tissue (Roll) Dispenser.
      b. T2 Sanitary Napkin Disposal (at designated female restrooms, grades 6 to adult only).
      c. T5 Grab Bars, 18 inch; (2) each, vertical.
      d. T5 Grab Bars, 42 inch; (2) each.

C. Type L - Lavatories:
   1. T9 Mirror.
   2. T11 Soap Dispenser. At locations with multiple lavatories, provide at a ratio of (1) dispenser per (2) lavatories.

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3. T23 Undersink Piping Covers per lavatory.

D. Type T – Toilet Rooms:
   1. Type T1 Single-User Toilet Room:
      a. T1 Toilet Tissue (Roll) Dispenser.
      b. T2 Sanitary Napkin Disposal (at unisex or designated female restrooms, grades 6 to adult only).
      c. T5 Grab Bars, 18 inch, vertical.
      d. T4 Grab Bars, 36 inch.
      e. T5 Grab Bars, 42 inch.
      f. T6 Paper Towel (Roll) Dispenser.
      g. T9 Mirror.
      h. T11 Soap Dispenser.
      i. T13 Coat/Clothes Hook.
      j. T23 Undersink Piping Covers.

E. Type WF - Wash Fountains
   1. T9 Mirror, one per station.
   2. T11 Soap Dispenser, (2) each.
   3. T23 Undersink Piping Covers, if wash fountain is not provided with skirt.

END OF SECTION

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SECTION 104400
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 061000 - 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; 2026.

C. UL (DIR) - Online Certifications Directory; Current Edition.

D. International Fire Code.

1.05 SUBMITTALS

A. See Section 013000 - 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 extinquishers, 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.

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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. Kidde, a unit of United Technologies Corp: www.kidde.com.
   3. Larsen's Manufacturing Co: www.larsensmfg.com.
   4. Nystrom, Inc: www.nystrom.com/sle.
   5. Potter-Roemer: www.potterroemer.com.
   6. Samson Products, Inc.: www.samsonproducts.com.
   7. Strike First Corporation of America: www.strikefirstusa.com.
   8. Substitutions: See Section 016000 - 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. Product - reference schedule below: Model numbers are based on Larsen's Manufacturing Co.

Wall Construction	Model	Fire Rated	Projection	Box Depth	Wall Depth
3-5/8" Metal Stud or 6" CMU	AL-2409-6R	No	2-1/2"	6"	4"
3-5/8" Metal Stud or 6" CMU	AL-FS-2409-R4	Yes	3-1/2"	6"	4"
8" CMU or wider	AL-2409-6R	No	2-1/2"	6"	4"
8" CMU or wider	AL-FS-2409-6R	Yes	2-1/2"	6"	4-7/8"
8" CMU	AL-2712-RA	No	4"	8"	4-1/2"
8" CMU	AL-FS-2712-RA	Yes	4"	8"	5-3/8"

B. Cabinet Configuration: Semi-recessed type.
   1. Projected Trim: Returned to wall surface, with 2-1/2 inch projection, and 1 inch wide face.

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C. Door: 0.036 inch metal thickness, 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.

D. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Clear satin anodized aluminum.

H. 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

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SECTION 107300
PROTECTIVE COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. 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.

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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 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.
   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.

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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.

2.03 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.

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END OF SECTION

SECTION 122100
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 013000 - 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.

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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 123200
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 061000 - Rough Carpentry: Blocking and nailers for anchoring casework.

B. Section 079200 - Joint Sealants: Sealing joints between casework and countertops and adjacent walls, floors, and ceilings.

C. Section 088000 - Glazing: Methods for shop-glazing of casework.

D. Section 123600 - Countertops: Additional requirements for countertops.

1.03 DEFINITIONS

A. Exposed: Portions of casework visible when drawers and cabinet doors are closed, including end panels, bottoms of cases more than 42 inches above finished floor, tops of cases less than 72 inches above finished floor and all members visible in open cases or behind glass doors.

B. Semi-Exposed: Portions of casework and surfaces behind solid doors, tops of cases more than 72 inches above finished floor and bottoms of cabinets more than 30 inches but less than 42 inches above finished floor.

C. Concealed: Sleepers, web frames, dust panels and other surfaces not generally visible after installation and cabinets less than 30 inches above finished floor.

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. ANSI/AWI 0641 - Architectural Wood Casework Standard; 2019.

E. ASTM C1036 - Standard Specification for Flat Glass; 2021.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

G. BHMA A156.9 - Cabinet Hardware; 2020.

H. 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 013000 - 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.

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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 ANSI/AWI 0641 - 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-UPS

A. Provide full size base cabinet, upper cabinet, and tall cabinet complete with drawers, door, adjustable shelf and countertop of every finish type.

B. See Section 014000 - 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 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a two 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.

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PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer shall be members in good standing of the Architectural Woodwork Institute (AWI).

B. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 CASEWORK, GENERAL

A. Quality Standard: ANSI/AWI 0641 - Architectural Woodwork Standards; 2019.

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 MATERIALS

A. Hardwood Lumber: NHLA; Graded in accordance with ANSI/AWI 0641, 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.

2.04 PANEL MATERIALS

A. 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.

B. Particleboard: ANSI A208.1; medium density industrial type, minimum 45 lb./cu. ft. density, Grade 1-M-2 or better, as specified in ANSI/AWI 0641, 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.

C. Medium Density Fiberboard (MDF): ANSI A208.2 ; type as specified in ANSI/AWI 0641; 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

D. 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.

2.05 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 solid lumber.

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.

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E. Glazing for Doors: 1/4 inch 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 36 inches wide maximum, 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.

O. Countertop Metal Supports: Hidden metal support brackets of size and configuration as required for support of countertops depth as detailed in the drawings.
   1. Manufactures:
      a. Centerline Brackets: www.countertopbracket.com
      b. Substitutions: See Section 016000 - Product Requirements.

2.06 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 scheduled.
      d. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
      e. Cap exposed plastic laminate finish edges with plastic trim.
         1) 3mm PVC, flat shaped; smooth finish; of width to match component thickness

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(a) Door and drawer fronts (Color match to face laminate).
(b) Counter top exposed edges (Color match to face laminate).

2) 1mm PVC, flat shaped; smooth finish; of width to match component thickness.
(a) Exposed component edges (Color match to face laminate).
(b) Backsplash and return exposed edges (Color match to face laminate).

2.07 COUNTERTOPS

A. Countertops: See Section 123600.

2.08 CABINET HARDWARE

A. Manufacturer's standard types, styles and finishes, and as indicated below.

B. Comply with BHMA A156.9 requirements.

C. Locks: Provide locks on casework drawers and doors where indicated. Comply with BHMA A156.11, Grade 1..
1. Cam Locks:
a. Door and Drawer (CompX 8053 Disc Tumbler Cylinder)
b. Substitutions: See Section 016000 - Product Requirements.
2. Elbow Catches (Inactive Doors):
a. EC-2-26D
b. Substitutions: See Section 016000 - Product Requirements.
3. Coordinate keying with Owner.
4. Keying: Key locks alike within a space; key each room separately.
5. Master Key System: All locks operable by master key. Master key system must handle 2,000 key changes minimum.See Section 08 7100 for keying requirements.

D. Shelves in Cabinets:
1. Shelf Standards and Rests: 4 Standards (K & V)#255, 4 Brackets/Shelf(K & V)#256.

E. Swinging Doors: Hinges, pulls, and catches.
1. Hinges: Semi-Concelaed, number as required by referenced standards for width, height, and weight of door.
a. Semi-Concealed Hinges: Installed as required by hinge design, satin chromium plated over nickel on base material.
1) Five knuckle wraparound hinges for flush overlay condition.
2. Pulls: Satin Chrome wire pulls, 4 inches wide.
a. Pull design to comply with project's referenced accessibility requirements.
3. Catches: Magnetic.

F. Drawers: Pulls and slides.
1. Pulls: Satin Chrome wire pulls, 4 inches wide (typical).
a. Pull design to comply with project's referenced accessibility requirements.
2. Slides: Steel, full extension arms, ball bearings; soft close,capacity as recommended by manufacturer for drawer height and width.

G. Pull-Out Keyboard Tray
1. Each to have:(K & V)#5710

H. Clothes Rod each to have:
1. Rod(K & V)#770 5
2. Flange(K & V)#764 CHR

I. Adjustable Shelves at Display Cases, each to have:
1. Standards (K & V)#87
2. Brackets/Shelf(K & V)#186

J. Casters:

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1. Swivel-type: 4-inch diameter wheels of soft or hard rubber and self-lube wheel bearing. Swivel is double-level, hardened ball bearing. All metal surfaces are zinc-plated.
2. Rigid-type: 4-inch wheels of soft or hard rubber, held in horns of formed steel, zinc plated. Wheel spanner bushings. Load capacity is 225 pounds per caster. Brake available on both swivel and rigid.

2.09 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.

2.10 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.

E. Concealed Fastening Clips: Provide for accessible panels and other areas indicated on the drawings.

F. Cable Management Tray: Size and configuration required for application.

G. Door/Drawer Silencers: 2 per door/drawer minimum, 3 for door/drawers over 48 inches.

PART 3 EXECUTION

3.01 PREPARATION

A. Large Components: Ensure that large components can be moved into final position without damage to other construction.

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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 inchper 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.

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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 123600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surfacing.
   1. Plastic Laminate Countertops.
   2. Solid Surfacing Countertops, Bench Top and Sills.

1.02 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 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.03 SUBMITTALS

A. See Section 013000 - 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.

1.04 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.

1.05 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.

1.06 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 - BENCH TOPS

A. Quality Standard: See ANSI/AWI 0641 - Architectural Woodwork Standards; 2019.

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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 016000 - 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. Solid Surfacing Countertops, Bench Tops and Sills: Solid surfacing sheet or plastic resin casting self-supporting over structural members.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or 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) Avonite Surfaces: www.avonitesurfaces.com/#sle.
         2) Dupont: www.corian.com/#sle.
         3) Formica Corporation: www.formica.com/#sle.
         4) Meganite, Inc: www.meganite.com/#sle.
         5) Relang International, LLC: www.duraseinusa.com/#sle.
         6) Wilsonart: www.wilsonart.com/#sle.
         7) Substitutions: See Section 016000 - 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. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20or as scheduled in the Schedule of Materials and Colors.
      e. 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.

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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.

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.

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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 21 1313
FIRE SPRINKLER PIPING SYSTEM

PART 1 GENERAL

1.01 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. Fire protection system drawings, refer to sheets beginning with “[FP].”

1.02 SUMMARY

A. The Work covered by this Specification Section includes providing and furnishing all design, engineering, labor, materials, transportation, tools, piping, fittings, valves, hangers and supports, devices, sprinklers, and any other components and services required for the installation of a complete, operational, fully functional, and code compliant automatic sprinkler systems.

B. The Work must comply with all requirements of these specifications, including where the specified requirements are exceeding minimum code requirements. Any design inconsistencies or conflicts within this document must be resolved through the Request for Information (RFI) process prior to the contractor’s bid submission. All fire alarm system related RFIs will be reviewed and processed by the Owner’s Representative and Design Team.

C. The Contractor shall perform all Work in accordance with the Specifications, and subject to the terms and conditions of the Contract. Work shall include, but not be limited to, the following as applicable:
   1. Wet pipe automatic sprinkler systems.

D. No Work shall be performed until the Shop Drawings, calculations, and product data have been approved by the Owner’s Representative, Design Team, and Authority Having Jurisdiction (AHJ). The Contractor is solely liable for any material purchases made prior to the approval of the drawings.

1.03 DEFINITIONS

A. Design Team: engineers of record, architect, and other professionals involved in the development of the contract documents.

B. Standard-Pressure Sprinkler Piping: Wet pipe sprinkler system piping designed to operate at working pressure of 175 psi maximum.

1.04 SYSTEM DESCRIPTIONS

A. Wet-Pipe Automatic Sprinkler System: Automatic sprinklers are attached to water-filled piping that is connected to a reliable water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.

1.05 PERFORMANCE REQUIREMENTS

A. Delegated Design: Contractor is responsible for a complete design complying with the applicable codes and standards, this Specification Section, and all Related Documents.

B. Automatic sprinkler system design shall be approved by the authorities having jurisdiction.
   1. Margin of Safety for Available Water Flow and Pressure: 10 percent or greater where required by the local authority having jurisdiction (AHJ), including losses through water-service piping, valves, hose connections, and backflow preventers.
   2. Sprinkler Occupancy Hazard Classifications shall be in accordance with applicable edition of NFPA 13.
   3. Minimum Density for Automatic-Sprinkler Piping Design:
      a. Light Hazard: 0.10 gpm/ft^2 over 1,500 ft^2.
      b. Ordinary Hazard Group 1: 0.15 gpm/ft^2 over 1,500 ft^2.

c. Ordinary Hazard Group 2: 0.20 gpm/ft^2 over 1,500 ft^2.
d. Wet pipe automatic sprinkler system design may be decreased for the use of quick response sprinklers in accordance with NFPA 13.

4. Maximum Protection Area per Sprinkler: Per NFPA 13.
5. Total Combined Hose-Stream Demand Requirement: Per NFPA 13.
6. System area shall not exceed 52,000 square feet or the area of the smoke compartment protected [or 40,000 square feet for high-hazard areas], whichever is less.
7. A single sprinkler system shall not serve more than one (1) smoke compartment.
8. Standard Piping System Component Working Pressure: Listed for at least 175 psi.

1.06 ACTION SUBMITTALS

A. General Submittal Requirements:
1. Submittals shall be reviewed by the Design Team prior to submitting them to authorities having jurisdiction.
a. Should any submittal not be approved by the owner, owner's representative, or local authority and require re-submittal, all changes to the drawings, resulting from comment corrections or drawing changes, shall be individually clouded, provided with a reference number reflecting the date of resubmission, and provided with a general description of the changes.
b. Should re-submission (submittal after initial submittal) not be approved and require a subsequent submittal (third and beyond), the owner reserves the right to back charge the contractor for any review costs and/or permit fees for subsequent submittals incurred by the owner and/or the owner's representatives, including but not limited to the architect and the fire protection consultant.
2. Comply with:
a. NFPA 13 "Plans and Calculations" chapter.

B. Simultaneous Action Submittals: Delegated-Design Product Data Submittal, Delegated-Design Calculation Submittal, Delegated-Design Shop Drawings, and Manufacturer's Fire Pump Curve submittal (if applicable) shall be submitted simultaneously. Incomplete submittals will be returned as "Rejected".

C. Specification Compliance Confirmation: Provide a copy of this specification annotated to confirm review and compliance with all applicable sections. Indicate compliance with a green checkmark adjacent to the respective section. Where a section is not applicable, mark the section as "NA" in red text and provide a concise explanation why the section is not applicable. Substitution requests shall be marked with an "S" in blue text and a reference to the formal Request for Information (RFI).

D. Delegated-Design Product Data Submittal: Provide product data sheets for all piping, material, equipment, and devices being proposed. If the product data sheet lists more than a single product, provide a clear indication of which product/model number is being proposed. Product submittals shall be electronically submitted in .pdf format with linked bookmarks corresponding with a table of contents organized by component type. Include the following:
1. Piping materials, including dielectric fittings, flexible connections, and specialty fittings.
2. Pipe hangers and supports, including seismic restraints where applicable.
3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
4. Sprinklers, escutcheons, cover plates, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
5. Hose connections, including size, type, and finish.
6. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
7. Alarm devices, including electrical data.
8. Hydraulic information for fittings, valves, and sprinklers.

E. Delegated-Design Calculation Submittal: Signed and sealed/stamped by the qualified professional responsible for their preparation. Hydraulic calculation submittals shall be electronically submitted in .pdf format with linked bookmarks corresponding with a table of contents organized by design area. Include the following:
   1. Hydraulic calculations in accordance with NFPA 13 and 14.

F. Delegated-Design Shop Drawings: Signed and sealed/stamped by the qualified professional responsible for their preparation. Include the following:
   1. All applicable information listed in Chapter 23 of NFPA 13 and Chapter 4 of NFPA 20.
   2. Riser detail showing valves, fittings, pipe diameters and lengths, devices, and hydraulic nodes.
   3. Sufficient building information to convey the hazards, obstructions, uses, walls, ceilings, structure, ceiling/deck heights, and pertinent information necessary to confirm the design is compliant.
   4. Sprinkler legend on each sheet with the total sprinkler count, coverage type (e.g., standard, extended, etc.), SIN, response-type, temperature rating, finish, color, k-factor, minimum operating pressure or flow (where manufacturer specified), dry-type (where applicable), maximum spacing calculated and used for extended coverage sprinklers (where permitted), and orientation.
   5. Where flexible sprinkler drops are used, indicate on the drawings the manufacturer, maximum length, maximum number of bends, and equivalent length used at each location (where it varies). Must match the product data and the hydraulic calculations.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Designer and Installer:
   1. Copy of State license showing the fire sprinkler contractor to be certified in the layout and installation of fire sprinkler systems.
   2. Copy of NICET certification showing the fire sprinkler contractor to be certified in the layout, equipment selection, installation, acceptance testing, troubleshooting, servicing and sales of automatic sprinkler systems.

1.08 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire protection systems and components to include in operation and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
   1. Provide a minimum of three (3) hardcopies of NFPA 25, edition referenced by the applicable edition of NFPA 13. The copies provided shall be purchased from NFPA and shall not violate copyright laws.
   2. Manufacturer’s required maintenance related to system warranty requirements.

B. Final Testing and Completion Documents: Indicate, document, and interpret test results for compliance with performance requirements in accordance with NFPA standards.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

F. Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification number as specifically published in the appropriate agency listing or approval. Trade names or other abbreviated designations shall not be allowed.

1.09 QUALITY ASSURANCE

A. The installation shall be performed by a company specializing in designing and installing the products specified in this Section with a minimum of five (5) years of experience, and certified/licensed by the appropriate State agency for such work.

B. Common Requirements for Code Compliance: In cases where differences occur between building codes, state laws, local ordinances, industry standards, and the Contract Documents, the most stringent shall apply. Perform the following:
   1. Promptly notify the Owner or Owner's Representative in writing of any such difference.
   2. Obtain approval from the Owner or Owner's Representative before proceeding with the Work.
   3. Should the Contractor perform any work that knowingly does not comply with local codes, laws and ordinances, industry standards, or other governing regulations, the Work shall be corrected at no cost to the Owner.

C. Common Requirements for Compliance with AHJ Instructions: In cases where the Authority Having Jurisdiction requires deviations from the requirements of the Contract Documents, perform the following:
   1. Promptly notify the Owner or Owner's Representative in writing of any such difference.
   2. Obtain approval from Owner or Owner's Representative before proceeding with the Work.

D. Common Requirements for Material Quality: Materials, equipment, and devices shall be new and of the quality specified and shall be free from defects at the time of installation. Materials, equipment, and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall be replaced with new materials, equipment, or devices identical with those damaged, unless approved otherwise by the Owner in writing.

E. Designer Qualifications: Shop Drawings and Calculations shall be prepared and signed by personnel with the following qualifications:
   1. Trained and certified by manufacturer.
   2. Certified by NICET as Level III (or higher) in Water-based Fire Protection Systems or a qualified professional engineer.
   3. Current Qualifying License issued by the State.

F. Installer Qualifications: Personnel shall be trained and be certified by NICET in Water-based Fire Protection Systems as follows:
   1. Foreman: Level III or higher.
   2. Pipe Fitter: Level I or higher.

G. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

H. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13, Standard for the Installation of Sprinkler Systems, applicable edition.

I. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools for 1-inch grooved piping shall be supplied from the same manufacturer as the grooved components.

1.10 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Coordinate the installation of supervised and activated devices with the fire alarm contractor.

C. Coordinate the installation of piping in shared support systems with other trades using the shared support system.

D. Space allocations for materials, equipment, and devices have been made based on present and known future requirements and the dimensions of items of equipment or devices of a specific manufacturer. Verify that all materials, equipment, and devices proposed for use on this Project are within the constraints of the allocated space.

E. Coordinate arrangement, mounting, and support of materials, devices, and equipment:
   1. To allow maximum possible headroom.

2. To provide for ease of accessing equipment and devices with minimum interference to other installations.

F. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components, as they are constructed.

G. Coordinate location of access panels and doors for valves that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08.

H. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for required spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench.

PART 2 PRODUCTS

2.01 STEEL PIPE AND FITTINGS

A. Threaded-End, Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.
1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Ductile- and Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865.

B. Plain-End, Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.
1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

C. Grooved-End, Schedule 10 or Schedule 40 Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, roll-grooved ends in NPS 1¼ and larger.
1. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 2½ and larger; and NFPA 13-specified wall thickness in NPS 6 to NPS 10; with factory- or field-formed, roll-grooved ends.
2. Grooved-End, Schedule 40 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 40 in NPS 1¼ to 2; with factory- or field-formed, roll-grooved ends.
3. Grooved-End, Schedule 40 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 40 in NPS 1 ; with factory- or field-formed, grooved ends using a Victaulic 1-inch groover and Victaulic 1” grooved fittings.
4. Grooved-Joint Piping Systems:
a. Manufacturers:
1) Anvil International, Inc.
2) Victaulic Co. of America.
b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD or ASTM A53 forged or fabricated from carbon steel pipe with factory grooved ends designed to accept grooved mechanical couplings from the same manufacturer.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, synthetic rubber gasket listed for use with housing, and steel bolts and nuts.
1) Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13.

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Tongue and recess rigid type couplings shall only be used if the contractor uses a torque wrench for installation. Required torque shall be in accordance with the manufacturer's latest recommendations.

(a) Victaulic 1" couplings.
(b) 1¼" through 4": "Installation Ready" stab-on design, for direct 'stab' installation onto grooved end pipe without prior field disassembly and no loose parts.
(c) 5" and larger: Standard rigid coupling.

d. Grooved-End-Pipe Flange Adapters: UL213 and AWWA C606, steel pipe OD dimensions, ASTM A536 ductile iron housing, flat faced, designed for incorporating flanged components with ANSI Class 125 bolt-hole patterns to a grooved piping system.

D. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 4 and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10.
1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

2.02 DIELECTRIC FITTINGS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

B. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.

C. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.

D. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.

E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.

F. Dielectric Nipples: Electroplated steel or ductile iron with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 230 deg F.

2.03 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FM approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.

B. Outlet Specialty Fittings: Mechanical-T and Cross Fittings are prohibited and shall not be used on the project.

C. Sprinkler Drain and Alarm Test Fittings: Bronze, Cast- or ductile-iron body; with threaded or grooved inlet and outlet, test valve, and orifice and sight glass.

D. Sprinkler Inspector's Test Fitting: Bronze, Cast- or ductile-iron housing with threaded or grooved inlet and drain outlet and sight glass.

E. Flexible, Sprinkler Hose Fittings:
1. Standard: UL 2443 and FM 1637.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175 psig minimum.
4. Size: Same as connected piping, for sprinkler.

F. In-Building Riser:
   1. Standard:
      a. UL HKQA.
      b. NFPA 24.
      c. Outlet Connection:
         1) Grooved: AWWA C-606.
         2) Flange: AWWA C-207.
      d. Inlet Connection: AWWA C-900 PVC or Ductile-Iron Pipe.
      e. Material: ASTM A312 Type 304 stainless steel tubing.
      f. Pressure Rating: 200 psig minimum.
      g. Size: 4-inch to 10-inch.
      h. Lengths:
         1) Vertical: Custom 3 feet to 20 feet.
         2) Horizontal: Custom 3 feet to 20 feet.

2.04 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FM approved, with 175-psig minimum pressure rating.

B. Ball Valves: Comply with UL 1091, except with ball instead of disc.
   1. NPS 1½ and Smaller: Bronze body with threaded or grooved ends.
   2. NPS 2 and NPS 2½: Bronze body with threaded or grooved ends or ductile-iron body with grooved ends.

C. Butterfly Valves: UL 1091.
   1. NPS 2½ and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends. Weather-proof actuator with pre-wired supervisory switches monitoring the valve in the open or closed positions. Maximum 365 psig working pressure.

D. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron or ductile-iron body with flanged or grooved ends. Up to 365 psig (2517 kPa) maximum working pressure.

E. Gate Valves: UL 262, OS&Y type.
   1. NPS 2 and Smaller: Bronze body with threaded ends.
   2. NPS 2-1/2 and Larger: Cast-iron or ductile-iron body with flanged ends.

F. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.
   1. Indicator: Electrical, 24-Vdc, prewired, 2-circuit, supervisory switch.
   2. NPS 2 inch and Smaller: Ball or butterfly valve with bronze body and threaded ends.
   3. NPS 2½ inch and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

2.05 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FM approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.
   1. Riser Check Valves: UL listed or FM approved, designed for vertical or horizontal installation. Include trim sets for drain and pressure gauges. Valve internal components shall be replaceable without removing the valve from the installed position.
   2. Commercial Riser: UL listed or FM approved, designed for vertical or horizontal installation. Include trim sets for test/drain with orifice sized for the smallest K-factor in the system, 175 psi pressure relief valve, water flow switch, and pressure gauge.

B. Pressure-Relief Valves: UL Listed and/or FM Approved, brass or bronze, NPS 1/2 or NPS 3/4, 175-psig minimum rating. Include male NPS inlet and female NPS outlet, non-adjustable, and 90-degree-angle pattern design as indicated.
   1. Finish: Rough metal.

C. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

D. Automatic Air Vent:

1. Description: Automatic air vent that automatically vents trapped air without human intervention.
2. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler systems.
3. Vents oxygen continuously from system.
4. Float valve to prevent water discharge.
5. Minimum Water Working Pressure Rating: 175 psig.

2.06 SPRINKLERS

A. Sprinklers shall be UL listed or FM approved, with 175-psig minimum pressure rating.

B. Automatic Sprinklers: with heat-responsive element complying with the following:
   1. UL 199, for nonresidential applications.

C. Sprinkler Types and Categories: Minimum nominal 1/2-inch orifice for "Intermediate" temperature classification rating, unless otherwise indicated or required by application.
   1. All Sprinklers shall be Quick Response, unless required otherwise.

D. Sprinkler types, features, and options as follows:
   1. Concealed ceiling sprinklers, including cover plate.
   2. Pendent sprinklers.
   3. Quick-response sprinklers.
   4. Sidewall sprinklers.
   5. Sidewall, dry-type sprinklers.

E. Sprinkler Finishes:
   1. Finished ceilings: White or Chrome.
   2. Exposed: Bronze or Brass.

F. Special Coatings:
   1. Corrosive environments: Nickel-plated Teflon coated.

G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
   1. Ceiling Mounting: Chrome, one piece, flat.
   2. Sidewall Mounting: Chrome, one piece, flat.

H. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler. Sprinkler guards shall be listed, supplied, and approved for use with the sprinkler, by the sprinkler manufacturer.

2.07 FIRE HOSE VALVES

A. Description: UL 668, brass or bronze, 175-psig minimum pressure rating, hose valve for connecting fire hose. Include angle pattern design; female NPS or grooved inlet and male 3.098 x 8 TPI hose outlet; and lugged cap, gasket, and chain. NPS 2½ hose valve threads according to NFPA 1963 and matching local fire department threads.
   1. Valve Operation: Nonadjustable type.
   2. Finish: Rough metal.

2.08 FIRE VALVE CABINETS

A. Recessed mounted valve cabinet of 20 ga. Steel. Refer to architect for door, fire-resistance rating, and finish requirements. Cabinet must be large enough to accommodate hose valve indicated.

2.09 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connection: UL Listed and/or FM Approved, in accordance with AHJ requirements. Include caps; 18-inch-high to 36-inch-high, metal escutcheon plate with marking ["STANDPIPE & AUTOSPRK"] ["AUTOSPRK"].

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-Vac and 0.25 A, 24-Vdc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

C. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow.

D. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

2.11 PRESSURE GAUGES

A. Description: UL 393, 3-1/2- to 4-1/2-inch-diameter, dial pressure gauge with range of 0 to 300 psig.
   1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.

PART 3 EXECUTION

3.01 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13, NFPA 14, and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.

B. Report test results promptly and in a formal written report documenting the results in accordance with NFPA 13, NFPA 14, and NFPA 291.

3.02 EXAMINATION

A. Examine roughing-in for risers and valves to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose valve cabinets are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 SYSTEM APPLICATIONS

A. Wet-Pipe Automatic Sprinkler System: Provided throughout the building except where a dry-pipe or pre-action automatic sprinkler system is required.

3.04 PIPING APPLICATIONS, GENERAL

A. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

3.05 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:
   1. NPS 1 to NPS 2: Threaded-end, black or galvanized, Schedule 40 steel pipe; cast-, duct-, or malleable-iron threaded fittings; and threaded joints.
   2. NPS 2½ to NPS 6: Plain-end, black, Schedule 40 steel pipe; steel welding fittings; and welded joints.
   3. NPS 1 to NPS 2: Grooved-end, black or galvanized, Schedule 40 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
   4. NPS 2½ to NPS 6: Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

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3.06 VALVE APPLICATIONS

A. Listed Fire-Protection Valves: UL listed and FM approved for applications where required by NFPA 13.
   1. Shutoff Duty: Use ball, butterfly, or gate valves.

3.07 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe with wall thickness less than Schedule 40.

D. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.
   1. Steel Pipe: Roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
   2. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved coupling manufacturer.
   3. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing.

E. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.
   1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
   2. NPS 2½ to NPS 4: Use dielectric flanges.
   3. NPS 6 and Larger: Use dielectric flange insulation kits.

3.08 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

B. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

C. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

D. Install sprinkler piping with drains for complete system drainage.

E. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building to an approved location.

F. Install alarm devices in piping systems.

G. Hangers and Supports: Comply with NFPA 13 for hanger materials and system piping supports installation.

H. Install pressure gauges on risers on both the system side of the system valve and the supply side of the system valve. Include pressure gauges with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gauges to permit removal and install where they will not be subject to freezing.

I. Fill wet-pipe sprinkler system piping with water.

J. Install sleeves for piping penetrations of fire-resistance and smoke-resistance rated walls, ceilings, and floors.

K. Install sleeve seals for piping penetrations of CMU and concrete walls and slabs.

L. Install pipe escutcheons for piping penetrations of walls, ceilings, and floors.

M. Water-filled piping shall be limited in and coordinated in low voltage, electrical, and IT rooms.

3.09 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and NFPA 14 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

D. Specialty Valves:
   1. Riser Check Valves: Install in vertical position for proper direction of flow.

E. Air Vent:
   1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
   2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.

3.10 SPRINKLER APPLICATIONS

A. Where specific types are not indicated, use the following sprinkler types:
   1. Rooms without Ceilings: Bronze or Brass Upright sprinklers.
   2. Concealed sprinklers shall be installed in finished ceilings.
   3. Wall Mounting: Sidewall sprinklers.
   4. IT Rooms other than the MDF and UPS room, unless requested otherwise: Bright White Concealed horizontal sidewall sprinklers.
   5. Spaces Subject to Freezing: Dry pendent sprinklers, or Dry horizontal sidewall sprinklers.
   6. Special Applications: All Sprinkler heads to be Quick Response type, except Extra Hazard Occupancies.
   7. Install sprinkler guards for areas where sprinklers are subject to be inadvertently hit (i.e. gymnasiums, shops, etc.)

3.11 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

C. The sprinkler bulb protector must remain in place until the sprinkler is completely installed and before the system is placed in service. Remove bulb protectors carefully by hand after installation. Do not use any tools to remove bulb protectors.

D. Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

3.12 FIRE HOSE VALVE INSTALLATION

A. Install hose connections adjacent to standpipes, unless otherwise indicated.

B. Install freestanding hose connections for access and minimum passage restriction.

C. Install NPS 2½ hose connections.

3.13 FIRE VALVE CABINET INSTALLATION

A. Install recessed hose stations for access and minimum passage restriction.

B. Install NPS 2½hose connections.

C. Install wall-mounting, recessed type fire hose valves in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install

valves at angle required for connection of fire hose. Cabinets are specified in Division 10 Section "Fire Extinguisher Cabinets."

3.14 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install wall mount fire department connections surface mounted to exterior wall.

B. Install ball drip valve at each check valve for fire department connection.

C. Pipe ball drip valve to drain to the exterior of the building.

3.15 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

B. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping.

C. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

D. Electrical Connections: Power wiring is specified in Division 26.

E. Connect alarm devices to fire alarm.

F. Ground equipment according to Division 26.

G. Connect wiring according to Division 26.

H. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.16 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Provide hydraulic design information signs and general information signs at all system risers and control valve assemblies in accordance with NFPA 13.

3.17 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Energize circuits to electrical equipment and devices.
   4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
   5. Flush, test, and inspect standpipe systems according to NFPA 14, "System Acceptance" Chapter 11.
   6. Flush, test, and inspect standpipe systems according to NFPA 20 Chapter 14.
   7. Coordinate with fire alarm tests. Operate as required.
   8. Coordinate with fire-pump tests. Operate as required.
   9. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

C. Refer to Division 01 for additional field testing and commissioning requirements and information.

3.18 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

3.19 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves. Refer to Division 01.

B. Grooved coupling manufacturer’s factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

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SECTION 22 0010
GENERAL REQUIREMENTS FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The General Requirements for Plumbing Work are intended to be complementary to the General Requirements of the Construction Contract.

B. Work Included: Provide complete plumbing systems where shown on the drawings, as specified herein, and as needed for a complete and proper installation.

1.02 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers that are thoroughly trained and experienced in the necessary crafts and are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Architect/Engineer/Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. Codes: Perform all work in accordance with the latest edition of the following codes:
1. State and city building, fire, plumbing, and mechanical codes.
2. National Electrical Code (NEC)
3. National Fire Protection Association (NFPA)
4. American with Disabilities Act (ADA)
5. Texas Accessibility Standards (TAS)
6. All authorities having jurisdiction.

D. Where conflicts occur between drawings, specifications, and code requirements, the most stringent requirement shall take precedence.

E. Standards: The specifications and standards of the following organizations are by reference made a part of these specifications. All work, unless otherwise indicated, shall comply with the requirements and recommendations wherever applicable:
1. American National Standards Institute (ANSI)
2. Air Conditioning and Refrigeration Institute (ARI)
3. American Gas Association (AGA)
4. American Society for Testing and Materials (ASTM)
5. American Society of Plumbing Engineers (ASPE)
6. American Society of Mechanical Engineers (ASME)
7. American Society of Refrigeration, Heating and Air Conditioning Engineers (ASHRAE)
8. Electrical Testing Laboratories (ETL)
9. National Bureau of Standards (NBS)
10. National Electrical Manufacturer's Association (NEMA)
11. National Fire Protection Association (NFPA)
12. Underwriters Laboratories, Inc. (UL)

F. Electrical Characteristics for Equipment: Equipment of differing electrical characteristics may be furnished provided such equipment is proposed on the “Alternate Manufacturer Evaluation Form”, subsequently approved, and connecting electrical services, circuit breakers, and conduit sizes appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

G. When requested, provide the Owner’s Authorized Representative with manufacturer’s certificate that materials meet or exceed minimum requirements as specified.

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1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. The requirements and recommendations of the latest edition of the Occupational Safety and Health Administration (OSHA) Act are by reference made a part of these specifications. All work shall comply with the requirements and recommendations wherever applicable.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. All Other Sections of Divisions 21, 23, and 26 (as applicable).

B. All other divisions of the contract documents. Refer to each division's specifications and drawings for all requirements

1.05 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Provide Specifications per Division 01 for all submitted alternate equipment.

C. Product Data: Submit the following:
   1. Materials list of items proposed to be provided under Division 22.
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.
   3. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. All substitutions shall be approved in writing by Architect/Engineer. The Architect/Engineer’s decision shall be final.
   4. Allow a minimum of ten (10) working days for the review of submittals and each re-submittal.
   5. Compliance with the Contract documents shall be the sole responsibility of the Contractor. Items on equipment that are were not accepted by the Architect/Engineer in writing as an approved equal shall be replaced or revised to comply with the contract documents at the Contractor's expense.
   6. Manufacturer's recommended installation procedures which, when reviewed by the Architect/Engineer, shall become the basis for accepting or rejecting actual installation procedures used on the work.
   7. Sign the submittal as an indication of compliance with the contract documents. Any deviations from the contract documents shall be indicated on the submittal prior to signing. Any deviations not indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor’s expense.

D. See individual specification Sections for submittal requirements of materials and equipment.

E. Resubmittals of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor's disregard of Architect/Engineer's primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on Architect/Engineer's hourly rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus fifteen percent (15%).

F. Shop Drawings: Upon written request of the Contractor, the Architect/Engineer will provide directly to the Contractor electronic backgrounds of drawings required to produce shop drawings. The requirements to secure electronic files for shop drawing purposes are the same as for record drawing purposes. See 22 0010, Paragraph 1.15.H.2.

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1.06 SUBSTITUTIONS

A. The use of manufacturers' names and catalog numbers followed by the phrase "or equal" is generally used to establish a standard of quality and utility for the specified items and to provide a dimensional reference for construction documents that are drawn to scale.

B. Submittals for "equal" items shall, where applicable, include the following data that are not necessarily required for specified items:
   1. Performance characteristics.
   2. Materials.
   3. Finish.
   4. Certification of conformance with specified codes and standards.
   5. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in Paragraph 6 below.
   6. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/ Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Include shop drawings for all piping and ductwork equipment per Paragraph 1.5 Submittals. Organize in a clear and concise format.

C. Submittals of "equal" components or systems may be rejected if:
   1. The material or equipment would necessitate the alteration of any portion of the mechanical, electrical, architectural or structural design.
   2. Dimensions vary from the specified material or equipment in such a manner that accessibility or clearances are impaired or the work of other trades is adversely affected.

D. Proposed substitutions for materials or equipment must be submitted ten (10) days prior to final bid date for consideration as approved equals. Otherwise, such substitutions will not be permitted. Only Prime Bidders are allowed to make proposals for substitutions. Manufacturers, distributors, and sub-contractors shall not make proposals to the Architect/Engineer for substitutions.

E. No substitution shall be made unless authorized in writing by the Architect/Engineer. Should a substitution be accepted, and should the substitute material prove defective or otherwise unsatisfactory for the service intended, and within the guarantee period, replace this material or equipment with material or equipment specified, at no additional cost to the Architect/Engineer/Owner, and to the satisfaction of the Architect/Engineer.

F. Contractors submitting bids on substitute materials and equipment must also provide a written performance guarantee certifying that the substitute materials and equipment will produce the specified effects and meet the approval of the Architect/Engineer.

1.07 ORDINANCES, PERMITS, METERS, UTILITIES, AND ROYALTIES

A. Procure all permits and licenses necessary for completion of this project and pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. All required certificates of approvals and inspections by local governing and regulating authorities shall be obtained and paid for by the Contractor.

B. Pay all fees required for the connection of water, gas, and sewer to utility mains, and any meter fees if required.
   1. Pay any royalty payments required or fees for the use of patented equipment or systems. Defend all law suits or claims for infringement of any patent rights and shall hold the Owner and Architect/Engineer harmless from loss as a result of said suits or claims.

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1.08 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for satisfactory operation of all component parts of the mechanical systems to assure compatibility of all equipment and performance of the integrated systems in accordance with the requirements of the specifications. Should the Contractor consider any part of the specifications or drawings as rendering his acceptance of such responsibility impossible, prohibitive, or restrictive, he shall notify the Architect/Engineer before submitting his bid, and the bid shall be accompanied by a written statement of any objections or exceptions to the specifications and drawings.

1.09 EXISTING UTILITIES AND TEMPORARY SERVICES FOR CONSTRUCTION

A. Verify the location and capacity of existing utility services pertaining to work of Division 23. Relocate existing utilities unearthed by excavation as directed by the utility service companies affected.

B. Temporary Services for Construction
   1. Provide temporary services in strict accordance with the provisions of these specifications.

1.10 EXCAVATION AND BACKFILLING

A. Perform all excavation and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them in dry condition until the work has been installed. Properly perform all shoring required to protect the excavation and to safeguard employees.

B. Perform excavation and backfilling in strict accordance with the provisions of these specifications including trench safety requirements.

C. Make all excavations to the proper depth, with allowances made for floor slabs, forms, beams, etc. Properly compact ground under piping before installing piping.
   1. Provide backfilling in strict accordance with issued Geotechnical Engineering Report.

D. Remove from the site excavated materials not suitable and not used in the backfill.

E. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, repair them at no cost to the Architect/Engineer/Owner.

F. In a lime-stabilized area, fully restore the lime stabilization after the excavation is complete.

G. Replace concrete, curbs, paving, and other surface improvements cut during excavation to their original condition.

1.11 JOBSITE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Include required work to correct conditions detrimental to the timely and proper completion of all Division 22 Work. Do not proceed until unsatisfactory conditions are corrected.

1.12 PREPARATION AND COORDINATION

A. Perform coordination work in strict accordance with provisions of these specifications and the following:
   1. Coordinate as necessary with other trades to assure proper and adequate interface with all work.
   2. Where pipes and other plumbing items are shown in conflict with locations of structural members and other equipment, include labor and materials required for extensions, offsets and supports to clear the encroachment.
   3. Although such work is not specifically indicated, provide all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.
   4. Coordinate accepted equipment changes from those scheduled or specified with other trades affected. Additional compensation to other trades for equipment changes is the responsibility of the Contractor making the change.

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B. Plumbing Drawings are diagrammatic. Follow the drawings as closely as actual construction and work of other trades will permit. Piping arrangements have been designed for maximum economy consistent with good practice and other considerations. Install the systems arranged as shown on the drawings, except as otherwise approved in advance by the Architect/Engineer.

C. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.

D. Where items such as switches, valve boxes, control panels, etc. are not specifically located on the Drawings, provide an RFI to the Architect/Engineer, and locate as determined in the field by the Architect/Engineer. Where such items are installed without such specific direction, relocate as directed by the Architect/Engineer, and at no additional cost to the Architect/Engineer/Owner.

E. Verify all dimensions and distances. No additional compensation will be allowed because of differences between work shown on the Drawings and actual dimensions and distances at the jobsite.

1.13 CONSTRUCTION REQUIREMENTS

A. The drawings show the arrangements of work. Should project conditions necessitate rearrangement, or if the materials or equipment can be installed to a better advantage in a different manner, before proceeding with the work, prepare and submit Drawings of the proposed arrangement for the Architect/Engineer's review. Allow a minimum of ten (10) working days for review.

B. Should the Contractor propose to install equipment requiring space conditions other than those shown, or rearrange the equipment, he shall assume responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such changes shall be accompanied by contractor-generated detailed shop drawings of the space in question. Identify monetary credits proposed or other benefits of the change. Allow a minimum of ten (10) working days for review.

C. Properly locate and size all slots, holes, and openings in the building structure pertaining to the work and for the correct location of pipe sleeves, as applicable to the work.

1.14 CUTTING AND PATCHING

A. Perform cutting and patching associated with the work in strict accordance with the provisions of Division 01 of these Specifications and the following:
   1. Coordinate work to minimize cutting and patching work.
   2. Request for Architect/Engineer's Consent
      a. Prior to cutting or coring of the building structure, submit a written request to the Architect/Engineer for permission to proceed with cutting. Include x-rays of any floor area where cutting or coring is proposed.
      b. Contractor is cautioned that concrete floor may contain steel tendons, pipes, and electrical/telecom conduits, all of which can not be cut or damaged.
   3. Perform Architect/Engineer-approved cutting and demolition by methods that will prevent damage to other portions of the work and provide proper surfaces to receive installation of new work and repair.
   4. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.
   5. Provide all core drilling of holes. Where sleeves and blockouts are required, they shall be cut or provided at locations required. On completion of this work or as work progresses, make all repairs and do all patching required as a result of work under this Contract. All patching shall be performed in a manner that will restore the surrounding work to its original condition to the satisfaction of the Architect/Engineer.

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6. Assume responsibility for the proper size of all sleeves and blockouts in the building structure pertaining to the work and for providing the correct location of pipe sleeves and blockouts.
7. Where openings are cut through masonry walls, provide lintels or structural supports to protect the remaining masonry. Provide adequate support during the cutting operation to prevent any damage to the affected masonry.

1.15 PROJECT RECORD DOCUMENTS

A. Provide the record documents associated with the work of Division 22 in strict accordance with the provisions of these specifications.

B. Throughout progress of the Division 22 Work, maintain an accurate record of changes in the Contract Documents that apply to work of Division 22. Changes shall include all addendums issued during bidding. Maintain an accurate record of the location of mechanical service lines and outlets and all outside utilities.

C. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Architect/Engineer. Submit in writing at the pre-construction conference the name and credentials of the person responsible for record mark-ups and maintenance.

D. Accuracy of Records
1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of drawings and other documents where such entry is required to show the change properly. Match the symbology and format of the base documents.
2. Accuracy of records shall be such that a future verification of items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

E. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final Project Record Documents.

F. Making Entries on Drawings
1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
2. Date all entries.
3. Call attention to the entry by a "cloud" drawn around the area or areas affected.
4. In the event of overlapping changes, use different colors for the overlapping changes.
5. Make entries within 24 hours after receipt of information that the change has occurred.
6. Maintain the base drawing format and use the same symbology.
7. Convert field mark-ups to finished CADD record drawings when required in this section.

G. Conversion of Schematic Layouts
1. In some cases on the drawings, arrangements of ductwork and piping and similar items are shown schematically and are not intended to portray precise physical layout. Determine final physical arrangement subject to the Architect/Engineer's approval. However, design of future modifications of the facility may require accurate information as to the final physical layout of items that are shown only schematically on the drawings.
2. Show on the job set of record drawings, by dimension accurate to within one inch, the centerline of each run of items such as all sleeves and piping, etc., below grade, in walls, or in the concrete slab. A surface mounted device indicates the exact location:
   a. Clearly identify the item by accurate note such as "Chilled Water" and the like.
   b. Show, by symbol or note, the vertical location of the item "under slab," "in ceiling plenum," "exposed," and the like.
   c. Make all identification sufficiently descriptive that it may be related reliably to the specifications.

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H. Final Project Record Documents
   1. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.
   2. Provide completed record drawings in PDF and one printed set reproducible of each drawing.
   3. Refer to Division 01 for additional requirements.

1.16 OPERATION AND MAINTENANCE DATA

A. Well before substantial completion, submit two copies of a preliminary draft of the proposed manual(s) to the Architect/Engineer for review and comments. Allow a minimum of ten (10) working days for review.

B. Submit specified number copies of the approved manual to the Architect/Engineer prior to indoctrination of operation and maintenance personnel.

C. Prepare in accordance with the following standards:

Format: Size: Paper: Text: Drawings:	8½" x 11" White bond, at least 20 lb. weight Neatly written or printed 11" in height preferable; bind in with text; foldouts acceptable; larger drawings are acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.
Flysheets:	Separate each section of the Manual with neatly prepared flysheets briefly describing contents of the ensuing section; flysheets may be in color.
Binding:	Use heavy-duty plastic or fiberboard covers with binding mechanism concealed inside the manual; 3-ring binders will be acceptable; all binding is subject to the Architect/ Engineer's approval.
Measurements:	Provide all measurements in U.S. standard units such as feet-and-inches, lbs, and cfm. Where items may be expected to be measured within ten years in accordance with metric formulae,

	provide additional measurements in the "International System of Units" (SI).

D. Provide front and back covers for each manual, using durable material approved by the Architect/Engineer, and clearly identified on or through the cover with at least the following information:
   1. Name and Address of Work
   2. Name of Contractor
   3. General subject of this manual
   4. Space for approval signature of the Architect/Engineer and approval date

1.17 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contents: Include at least the following:
   1. Neatly typewritten index near the front of the manual, giving immediate information as to location within the manual of all emergency information regarding the installation.
   2. Complete instructions regarding operation and maintenance of all equipment provided including lubrication, disassembly, and reassembly.
   3. Complete nomenclature of all parts of all equipment.
   4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.
   5. Copy of all guarantees and warranties issued.
   6. Manufacturer's bulletins, drawings, and descriptive data, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
   7. Such other data as required in other sections of these specifications.

1.18 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations associated with the work in accordance with the provisions of these specifications

B. Provide concrete bases for all pad or floor mounted equipment. Bases shall be four inches (4”) high above finished floors or grades (unless otherwise noted) and shall protrude two inches (2”) beyond all sides of equipment and shall have exposed chamfer edges. Construct bases from ready-mixed hardrock concrete, ASTM C94, reinforced with #3 rebar, ASTM A615, Grade 40, at 18” on center each way.

C. Field verify exact location of outdoor pad mounted equipment with the Architect/Engineer. Supply necessary fill and grade site to provide natural drainage away from equipment.

1.19 PAINTING

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be damaged in transit or during the installation, it shall be finished to match appearance of original finish. All work shall be subject to approval by Architect/Engineer.

1.20 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from the Architect/Engineer and governmental agencies having jurisdiction.

B. Make written notice to the Architect/Engineer, adequately in advance, of each of the following stages of construction:
   1. When all rough-in is complete, but not covered;
   2. As specified in all Division 22 sections.
   3. At the completion of the work of Division 22.

C. When material or workmanship is found to not comply with the specified requirements, remove the noncomplying items from the job site and replace them with items complying with the specified requirements at no additional cost to the Architect/Engineer/Owner. This shall be performed within 3 days after receipt of written notice of noncompliance.

1.21 WARRANTY

A. Warranty all equipment and workmanship for a period of one year after date of substantial completion and replace or repair any faulty equipment or installation at no cost to the Architect/Engineer/Owner for such service during this period, all in accordance with requirements of Division 01.

B. 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.

C. Warranties shall be in writing in a form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

1.22 PROJECT COMPLETION

A. Upon completion of the work of Division 22, thoroughly clean all exposed portions of the mechanical installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.

END OF SECTION

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SECTION 22 0517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

C. FM (AG) - FM Approval Guide; Current Edition.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 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.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

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C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

E. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

F. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Structural Engineer.

G. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Modular Mechanical Sleeve-Seal:
   1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
   3. Size and select seal component materials in accordance with service requirements.
   4. Service Requirements:
      a. Corrosion resistant.
      b. Oil, fuel, gas, and solvent resistant.
      c. Underground, buried, and wet conditions.
      d. Fire Resistant: 3 hour, FM (AG) and UL (DIR) approved.
      e. High Temperature, up to 400 degrees F.
      f. Low temperature, down to minus 67 degrees F.
   5. Glass-reinforced plastic pressure end plates.

B. Sealing Compounds:
   1. Provide packing and sealing compound to fill pipe to sleeve thickness.
   2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

C. Pipe Sleeve Material:
   1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
   2. Masonry Structures: Sheet metal or fiber.

D. Wall Sleeve: Steel material with waterstop collar, and nailer end-caps.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Structural Considerations: Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber complying with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

C. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

END OF SECTION

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SECTION 22 0519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges.

B. Thermometers.

C. Pressure-temperature test plugs.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014 (Reapproved 2020).

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

E. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.

C. Project Record Documents: Record actual locations of components and instrumentation.

D. 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 Gauge Oil for Inclined Manometers: One bottle.
   3. Extra Pressure Gauges: One of each type and size.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Bourdon Tube for Liquids and Gases:
   1. Dial Size and Cover: 4-1/2 inch diameter scale with glass window.
   2. Dial Text and Markings: Black color on white background with scaled psi units.
   3. Accuracy: ASME B40.100, adjustable commercial grade (B) with 2 percent at mid-range of span.
   4. Process Connection: Lower-back, 1/4 inch NPT male except where noted.
   5. Corrossion Resistant Gauge Wetted Materials: Painted steel case and brass socket rated to match process pressure and temperature range.
   6. Comply with UL 393 when used for fire protection service or UL 404 when used for compressed gas service.

B. Accessories:
   1. Air or Gas Sensor: Static pressure with compression fittings for bulkhead mounting and 1/4 inch diameter tubing.
   2. Gauge Cock: Brass with tee or lever handle for maximum 150 psi.
   3. Needle Valve: Brass, 1/4 inch NPT female for noncorrosive service.
   4. Pressure Snubber (Pulsation Damper): Brass, 1/4 inch NPT male.
   5. Diaphragm Seal: 316L Stainless steel wetted material rated at 15 psi (1 bar), threaded. Select top size to match gauge size.

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2.02 THERMOMETERS

A. General:
   1. Product Compliance: ASTM E1.
   2. Lens: Clear glass, except where stated.
   3. Accuracy: Two percent, when tested in accordance with ASTM E77, except where stated.
   4. Scale: Black markings depicting single scale in degrees F where expected process value falls half-span of standard temperature range.

B. Thermometers - Adjustable Angle: 7 inch v-shape aluminum case with clear glass window scale, 6 inch NPT stem, red or blue organic non-toxic liquid filled glass tube, and adjustable joint with positive locking device allowing 360 degrees in horizontal plane or 180 degrees in vertical plane adjustments.

2.03 PRESSURE-TEMPERATURE TEST PLUGS:

A. Size: 500 psi capacity; 1/2 inch MPT brass fitting with gasket, cap, and retaining strap for 1/8 inch pressure gauge or temperature probe.

B. Wetted Materials per Temperature Range:
   1. Up to 200 degrees F: Brass probe with neoprene core.

C. Accessories: Brass, lever-handle cock and snubber-filter.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports, and test plugs.

3.02 INSTALLATION

A. Install pressure gauges as follows:
   1. At Pumps: Place single gauge before strainer, suction side and discharge side.
   2. Include gauge cock to isolate each gauge and extend nipples for insulation clearance.
   3. Adjust gauges to selected viewing angle, clean thoroughly, and calibrate to zero.

B. Install thermometers as follows:
   1. Water Heaters: Place upstream and downstream of heater. Add one on the inlet end when using steam as the water heating medium.
   2. Piping: Install thermometers in branch butt weld connection fitting or socket-weld thermowell. Enlarge pipes smaller than 2-1/2 inch to accommodate sockets. Ensure sockets are above insulation clearance.

C. Locate PT (pressure-temperature) test plugs adjacent to control device sockets.

END OF SECTION

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SECTION 22 0523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Angle valves.
B. Ball valves.
C. Butterfly valves.
D. Check valves.
E. Gate valves.
F. Lubricated plug valves.

1.02 RELATED REQUIREMENTS

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Non-rising stem.
E. OS&Y: Outside screw and yoke.
F. PTFE: Polytetrafluoroethylene.
G. RS: Rising stem.
H. TFE: Tetrafluoroethylene.
I. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.
C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022.
E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2020.
G. ASME B31.9 - Building Services Piping; 2020.
H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
I. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2019).
K. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
M. MSS SP-67 - Butterfly Valves; 2022.
N. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends; 2011.
O. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends; 2018.

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P. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010a.

Q. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.

R. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves; 2019.

S. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

T. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

U. NSF 372 - Drinking Water System Components - Lead Content; 2022.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.
   1. See Section 01 6000 - Product Requirements for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
   5. Secure check valves in either the closed position or open position.
   6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.

B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate.

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2. Dead-End: Single-flange butterfly (lug) type.
3. Swing Check (Pump Outlet):
   a. 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
   b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.

D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

E. Domestic, Hot and Cold Water Valves:
1. 2 inch and Smaller:
   a. Bronze and Brass: Provide with solder-joint ends.
   b. Bronze Angle: Class 125, bronze disc.
   c. Ball: Two piece, full port, brass with brass trim.
   d. Bronze Swing Check: Class 125, bronze disc.
   e. Bronze Gate: Class 125, NRS.
2. 2-1/2 inch and Larger:
   a. Iron, 2-1/2 inch to 4 inch: Provide with threaded ends.
   b. Iron Ball: Class 150.
   c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
   d. Iron Swing Check: Class 125, metal seats.
   e. Iron Gate: Class 125, NRS.

F. Natural Gas Valves:
1. 4 inch and Smaller:
   a. Ball: Two piece, full port, bronze with brass trim.
   b. Plug: Cast iron body and plug.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
1. Gear Actuator: Quarter-turn valves 8 inch and larger.
2. Handwheel: Valves other than quarter-turn types.
3. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.
4. Wrench: Plug valves with square heads.

D. Insulated Piping Valves: With 2 inch stem extensions and the following features:
1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: Extended neck.
4. Memory Stops: Fully adjustable after insulation is installed.

E. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 inch through 24 inch: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.

F. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.
3. Building Services Piping Valves: ASME B31.9.

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G. Potable Water Use:
   1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
   2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

H. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE, ANGLE VALVES

A. Class 125; CWP Rating: 200 psi:
   1. Comply with MSS SP-80, Type 1.
   2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
   3. End Connections: Pipe thread.
   4. Stem: Bronze.
   5. Disc: Bronze.
   6. Packing: Asbestos free.
   7. Handwheel: Bronze or aluminum.

2.04 BRASS, BALL VALVES

A. One Piece, Full Port with Brass Trim and Threaded or Soldered Connections:
   1. Comply with MSS SP-110.
   2. CWP Rating: 200 psi.
   3. Body: Forged brass.
   4. Seats: PTFE.
   5. Stem: Brass.
   6. Ball: Chrome-plated brass.
   7. Operator: Handle.

2.05 IRON, BALL VALVES

A. Class 125, Full Port, Stainless Steel Trim:
   1. Comply with MSS SP-72.
   2. CWP Rating: 200 psi.
   3. Body: ASTM A536 Grade 65-45-12, ductile iron.
   4. End Connections: Flanged.
   5. Seats: PTFE.
   6. Stem: Stainless steel.
   7. Ball: Stainless steel.
   8. Operator: Lever with locking handle.

2.06 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Wafer Style:
   1. Class 125, or Class 150 flanges.
   2. Comply with MSS SP-67, Type I.
   3. Wafer Style, Service Pressure Ratings:
      a. 150 psi for sizes 14 to 24 inch.
      b. 200 psi for sizes 2 to 12 inch.
      c. Vacuum down to 29.9 in-Hg.
   4. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
   5. Stem: One or two-piece stainless steel.
   6. Seat: EPDM.
   7. Disc: Aluminum-bronze.
   8. Finish: Epoxy coated.
   9. Operator: Gear operator with handwheel over direct-mount actuator base.

2.07 BRONZE, SWING CHECK VALVES

A. General:

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1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Class 125:
1. Pressure and Temperature Rating: MSS SP-80, Type 3.
2. Design: Y-pattern, horizontal or vertical flow.
3. WOG Rating: 200 psi.
4. Body: Bronze, ASTM B62.
5. End Connections: Threaded or soldered.
6. Disc: Bronze.

2.08 IRON, HORIZONTAL SWING CHECK VALVES

A. Class 125:
1. Pressure and Temperature Rating: MSS SP-71, Type I.
2. Design: T-body style for clear or full waterways.
3. WOG Rating: 200 psi.
4. Body: ASTM A126, gray cast iron with bolted bonnet.
5. End Connections: Flanged.
6. Trim: Composition.
7. Seat Ring and Disc Holder: Bronze.
8. Disc: PTFE.
9. Gasket: Asbestos free.

2.09 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.
1. Comply with MSS SP-71, Type I.
2. Description:
a. CWP Rating: 200 psi.
b. Design: Clear or full waterway.
c. Body: ASTM A126, gray iron with bolted bonnet.
d. Ends: Flanged as indicated.
e. Trim: Bronze.
f. Gasket: Asbestos free.
g. Closer Control: Factory installed, exterior lever, and weight.

2.10 BRONZE, GATE VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Rising Stem or OS&Y:
1. Pressure-Temperature Range: MSS SP-80, Type I.
2. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
3. End Connections: Threaded or solder.
4. Stem: Bronze.
5. Disc: Solid wedge; bronze.
6. Packing: Asbestos free.
7. Handwheel Operator: Malleable iron.

2.11 IRON, GATE VALVES

A. Bolted Bonnet: OS&Y; Rising Stem:
1. Pressure and Temperature Rating: MSS SP-70, Type I.
2. Class 125: WOG Rating; 200 psi.
3. Body: ASTM A126, gray iron with bolted bonnet.
4. End Connections: Flanged.

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5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

2.12 LUBRICATED PLUG VALVES

A. Regular Gland with Threaded Ends:
   1. Comply with MSS SP-78, Type II.
   2. Class 125: CWP Rating: 200 psi.
   3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
   4. Pattern: Regular or short.
   5. Plug: Cast iron or bronze with sealant groove.
   6. Packing: Teflon or Buna N

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:
   1. Lift Check: Install with stem plumb and vertical.
   2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

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SECTION 22 0529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefabricated trapeze-framed systems.
B. Strut systems for pipe or equipment support.
C. Beam clamps.
D. Pipe hangers.
E. Pipe rollers and roller supports.
F. Pipe supports, guides, shields, and saddles.
G. Nonpenetrating rooftop supports for low-slope roofs.
H. Anchors and fasteners.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
B. Section 05 5000 - Metal Fabrications.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
B. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).
A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.
D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
E. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
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; 2023.
H. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
K. FM (AG) - FM Approval Guide; Current Edition.
L. MFMA-4 - Metal Framing Standards Publication; 2004.
M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

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N. UL (DIR) - Online Certifications Directory; Current Edition.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.

D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

E. Fire Resistance: Provide hardware rated for 60 minutes resistance unless specifically indicated by the authority having jurisdiction.

F. Materials for Metal Fabricated Supports: Comply with Section 05 5000.

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1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

G. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

2.02 PREFABRICATED TRAPEZE-FRAMED SYSTEMS

A. Prefabricated Trapeze-Framed Metal Strut Systems:
1. MFMA-4 compliant, pre-fabricated, MSS SP-58 Type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
2. Strut Channel or Bracket Material:
a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
3. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
5. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

2.03 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

A. Strut Channels:
1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

B. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2 inch diameter.
b. Piping up to 1 inch: 1/4 inch diameter.
c. Piping larger than 1 inch: 3/8 inch diameter.
d. Trapeze Support for Multiple Pipes: 3/8 inch in length.

C. Channel Nuts:
1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring as indicated on drawings.

2.04 BEAM CLAMPS

A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.

B. C-Clamp: MSS SP-58 type 23, malleable iron and steel with stainless steel and zinc finish.

C. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with zinc finish. For inverted usage provide manufacturer listed size(s).

D. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with zinc finish.

E. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with zinc finish.

F. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plated finish.

G. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

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H. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.05 PIPE HANGERS

A. Clevis Hangers, Adjustable:
   1. Light-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.
   2. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.06 PIPE CLAMPS

A. Riser Clamps:
   1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
   2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, stainless steel, or zinc plated finish.
   3. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

B. Extension Split Pipe Clamp:
   1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with zinc finish.
   2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
   3. Provide hanger rod and nuts of the same type and material for a given pipe run.
   4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Strut Clamps:
   1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.

D. Insulation Coupling:
   1. Two bolt-type clamps designed for installation under insulation.
   2. Material: Carbon steel with epoxy copper or zinc finish.

2.07 PIPE ROLLERS AND ROLLER SUPPORTS

A. MSS SP-58 type 43 based on required load, nonconductive and corrosion resistant.

B. Material: Zinc plated ASTM A36/A36M carbon steel or ASTM A47/A47M malleable iron.

2.08 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

B. U-Bolts:
   1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.

C. Intermediate Anchors and Pipe Alignment Guides:
   1. Pipe Sizes 6 inch and Smaller: Minimum clearance of 0.16 inch.
   2. Pipe Size 8 inch: 0.625 inch U-bolt with double nuts providing minimum clearance of 0.28 inch.
   3. Pipe Size 10 inch: 0.75 inch U-bolt.
   4. Pipe Sizes 12 to 16 inch: 0.875 inch U-bolt.
   5. Pipe Sizes 18 to 30 inches: 1 inch U-bolt.
   6. Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.

D. Pipe Alignment Guides, Galvanized steel:
   1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
   2. Pipe Sizes 10 inch and Larger: Roller type.

E. Pipe Shields for Insulated Piping:
   1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   2. General Construction and Requirements:

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a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
d. Service Temperature: Minus 40 to 178 degrees F.
e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

F. Pipe Supports:
1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up to 122 degrees F:
a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.
b. Support From Below: MSS SP-58 types 35 through 38.

G. Pipe Supports, Thermal Insulated:
1. General Requirements:
a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
c. Provide pipe supports for 1/2 to 30 inch iron pipes.
d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.
2. PVC Jacket:
a. Pipe insulation protection shields to be provided with ball bearing hinge and locking seam.
b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
c. Minimum Thickness: 60 mil, 0.06 inch.

2.09 NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS

A. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.

B. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

C. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

D. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

2.10 ANCHORS AND FASTENERS

A. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

B. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

C. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

D. Hollow Masonry: Use toggle bolts.

E. Hollow Stud Walls: Use toggle bolts.

F. Steel: Use beam ceiling clamps, beam clamps, machine bolts, or welded threaded studs.

G. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, stainless steel, or zinc finish.

H. Sheet Metal: Use sheet metal screws.

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I. Wood: Use wood screws.

J. Plastic and lead anchors are not permitted.

K. Powder-actuated fasteners are not permitted.

L. Hammer-driven anchors and fasteners are not permitted.

M. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

N. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   1. Channel Material: Use galvanized steel.
   2. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
   3. Manufacturer: Same as manufacturer of metal strut channel framing system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Field-Welding (where approved by Architect): Comply with Section 05 5000.

H. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

I. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
   2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Section 03 3000.
   5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

K. Secure fasteners according to manufacturer's recommended torque settings.

L. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 22 0548
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Piping Isolation:
   1. Provide vibration isolators for piping supports:
      a. Located in equipment rooms.
      b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
      c. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.
   2. Minimum Static Deflection:
      a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
      b. Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
   3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   4. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
   5. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Vibration-Isolated Structural Steel Bases:
   1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

B. Vibration-Isolated Concrete Inertia Bases:
   1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
   2. Minimum Base Depth: 6 inches.
   3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
   4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
   5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 3000.
   6. Pump Applications: Size and configure bases for piping elbow supports as required.

2.03 VIBRATION ISOLATORS

A. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
   2. Spring Elements for Spring Isolators:
      a. Color code or otherwise identify springs to indicate load capacity.
      b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.

c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
f. Selected to function without undue stress or overloading.

B. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Nonseismic:
a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
3. Open (Unhoused) Spring Isolators:
a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
c. Furnished with integral leveling device for positioning and securing supported equipment.
4. Resilient Material Isolator Hangers, Nonseismic:
a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
5. Spring Isolator Hangers, Nonseismic:
a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
6. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

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3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
   1. Vibration-Isolated Equipment Support Bases:
      a. Provide specified minimum clearance beneath base.
   2. Spring Isolators:
      a. Position equipment at operating height; provide temporary blocking as required.
      b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
      c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
   3. Isolator Hangers:
      a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
      b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
   4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
   5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
   6. Adjust isolators to be free of isolation short circuits during normal operation.
   7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify required clearance beneath vibration-isolated equipment support bases.
   3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

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SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Schedules:
   1. Submit plumbing component identification schedule listing equipment, piping, and valves.
   2. Detail proposed component identification data in terms of of wording, symbols, letter size, and color coding to be applied to corresponding product.
   3. Valve Data Format: Include id-number, location, function, and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Nameplates:
   1. Heat exchangers, water heaters, and other heat transfer products.
   2. Control panels, transducers, and other related control equipment products.
   3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.

B. Tags:
   1. Manual operated and automated control valves.
   2. Instrumentation, relays, gauges, and other related control equipment products.
   3. Ceiling tacks placed on lay-in ceiling surface to reference plumbing components.

C. Pipe Markers: 3/4 inch diameter and higher.

2.02 NAMEPLATES

A. Description: Laminated piece with up to three lines of text.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Nameplate Material:
      a. Flexible: Vinyl with adhesive backing per ASTM D709.
      b. Metal: Brass with center-side holes for screw fastening.

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2.03 TAGS

A. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, stamped letters, and corrosion-resistant ball chain. Up to three lines of text.

B. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Comply with ASME A13.1.

B. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

C. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

D. Identification Scheme, ASME A13.1:
   1. Primary: External Pipe Diameter, Uninsulated or Insulated.
      a. 3/4 to 1-1/4 inches: Use 8 inch field-length with 1/2 inch text height.
      b. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
      c. 2-1/2 to 6 inches: Use 12 inch field-length with 1-1/4 inch text height.
      d. Over 10 inches: Use 32 inch field-length with 3-1/2 inch text height.
   2. Secondary: Color scheme per fluid service.
      a. Combustible Fluids: White text on brown background.
      b. Compressed Air: White text on blue background.
      c. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
   1. Plumbing Equipment: Yellow.
   2. Plumbing Valves: Green.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive identification products.

B. Prepare surfaces for stencil painting, see Section 09 9123.

3.02 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Apply ASME A13.1 Pipe Marking Rules:
   1. Place pipe marker adjacent to changes in direction.
   2. Place pipe marker adjacent each valve port and flange end.
   3. Place pipe marker at both sides of floor and wall penetrations.
   4. Place pipe marker every 25 to 50 feet interval of straight run.

F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass fiber insulation.

B. Weather barrier coatings.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

D. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

F. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

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PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER INSULATION, PREFORMED

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.
   1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
   2. Water Vapor Permeance: Greater than 1.0 perm in accordance with ASTM E96/E96M.
   3. Resistance to Fungal Growth: No growth when tested in accordance with ASTM D5590.
   4. Color: As selected by Architect.

2.04 JACKETING AND ACCESSORIES

A. PVC Plastic Jacket:
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch.
      e. Connections: Brush on welding adhesive.

B. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch sheet.
   3. Finish: Smooth.
   4. Joining: Longitudinal slip joints and 2 inch laps.
   5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.

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PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   4. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 8400.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

K. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULES

A. Plumbing Systems:

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1. Domestic Hot Water Piping:
   a. Preformed Glass Fiber Insulation:
      1) Pipe Size Range: All Sizes.
      2) Thickness: 1-1/2 inch.
2. Domestic Cold Water Piping:
   a. Preformed Glass Fiber Insulation:
      1) Pipe Size Range: All Sizes.
      2) Thickness: 1 inch.
3. Roof Drainage Piping Above Grade:
   a. Preformed Glass Fiber Insulation:
      1) Pipe Size Range: All Sizes.
      2) Thickness: 1 inch.
4. Condensate Piping Located Inside Building:
   a. Preformed Glass Fiber Insulation:
      1) Pipe Size Range: All Sizes.
      2) Thickness: 1 inch.

END OF SECTION

SECTION 22 1005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.
B. Sanitary waste piping, above grade.
C. Domestic water piping, above grade.
D. Storm drainage piping, buried within 5 feet of building.
E. Storm drainage piping, above grade.
F. Natural gas piping, above grade.
G. Condensate and Forced Main piping
H. Pipe flanges, unions, and couplings.

1.02 RELATED REQUIREMENTS

A. Section 33 0110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
D. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.
E. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.
F. ASME B31.1 - Power Piping; 2022.
G. ASME B31.9 - Building Services Piping; 2020.
H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
J. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2025.
K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
L. ASTM B32 - Standard Specification for Solder Metal; 2020.
M. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
N. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
O. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.
P. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.
Q. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.
R. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
S. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

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T. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

U. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2025.

V. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).

W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

X. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2024.

Y. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems; 2024.

Z. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing; 2023b.

AA. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

BB. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

CC. FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential; 1989.

DD. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

EE. NSF 372 - Drinking Water System Components - Lead Content; 2022.

FF. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe; 2021.

GG. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

E. Project Record Documents: Record actual locations of valves.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Valve Repacking Kits: One for each type and size of valve.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

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E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement and ASTM F656 primer.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

C. Copper Tube: ASTM B306, DWV.
   1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, sovent.
   2. Joints: ASTM B32, alloy Sn50 solder.

2.04 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Pipe: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

B. Cross-Linked Polyethylene (PEX-a) Pipe: ASTM F876 and ASTM F877. (ONLY FOR USE FOR DOMESTIC WATER PIPING LESS THAN 2-INCH).
   1. Manufacturers:
      a. Uponor, Inc
   2. PPI TR-4 Pressure Design Basis:
      a. 160 psig at maximum 73 degrees F.
      b. 100 psig at maximum 180 degrees F.
      c. 80 psig at maximum 200 degrees F.

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3. Pipe: Provide in straight lengths for all pipes route above ceiling / overhead. Coiled pipe is only acceptable for pipes sizes 3/4" and smaller and installed within walls. All horizontal pipe to be provided with horizontal support channel.
4. Fittings: Brass and engineered polymer (EP) ASTM F1960.
5. Joints: ASTM F1960 cold-expansion fittings.

2.05 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement and ASTM F656 primer.

2.06 STORM DRAINAGE PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 service weight.
1. Fittings: Cast iron.
2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.07 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
1. Fittings: ASTM A234/A234M, wrought steel welding type.
2. Joints: Welded to ASME B31.1.

2.08 CONDENSATE AND FORCE MAIN PIPING

A. Copper Tube: ASTM B306, DWV.
1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, sovent.
2. Joints: ASTM B32, alloy Sn50 solder.

2.09 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:
1. Ferrous Pipe: Class 150 malleable iron threaded unions.
2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Sizes Over 1 inch:
1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Shielded, Heavy Duty No-Hub Couplings:
1. Testing: In accordance with ASTM C1540 and FM 1680.
2. Gasket Material: Neoprene complying with ASTM C564.
3. Band Material: Stainless steel.
4. Eyelet Material: Stainless steel.

2.10 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Compliance Requirements:
1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.

B. Materials in Contact With Gas:
1. Housing: Aluminum, steel (free of non-ferrous metals).
2. Seals and Diaphragms: NBR-based rubber.

C. Maximum Inlet Operating Pressure: Refer to contract drawings.

D. Output Pressure Range:
1. Line Pressure Regulator: Refer to contract drawings.

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2. Appliance Regulator: Refer to manufacturer's IOM.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide access where valves and fittings are not exposed.

H. Install water piping to ASME B31.9.

I. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

J. Sleeve pipes passing through partitions, walls, and floors.

K. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

L. Install unions downstream of valves and at equipment or apparatus connections.

M. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

3.04 INSTALLATION REQUIRMENTS FOR CROSS-LINKED POLYETHYLENE (PEX-A) PIPE:

A. Piping Installation:
   1. Install PEX piping system in compliance with the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition, and the Uponor PEX Piping Systems Installation Guide, current edition.
   2. PEX shall not be installed in areas within 5feet of UV light.
   3. PEX shall not be installed within 12” of any gas appliance vents.
   4. PEX shall not be installed within 12” of any light fixture.
   5. PEX shall not be installed at connections to or within 24” of domestic water heating equipment. Provide type L copper water tube for these applications. This shall include, but not necessarily be limited to, the following:
      a. gas and electric storage type and tankless water heaters
      b. hot water storage and thermal expansion tanks
      c. hot water circulating pumps
      d. thermostatic mixing valves
   6. All final stub-outs to plumbing fixtures and equipment shall be Type L copper with solder joint or mechanical pressfittings.

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7. Only approved and appropriate firestop materials shall be used with PEX piping.
8. When transitioning from PEX to other piping materials, follow the appropriate installation instructions for that product.
9. Install piping in full compliance with manufacturer`s Plumbing Installation Guide.

B. Hangers and Supports Installation:
1. Install supports suitable for PEX-a piping in compliance with local codes and the Uponor Piping Systems Installation Guide, current edition.

C. Pipe Joint Construction:
1. PEX-a Connections: Install per manufacturer's recommendations. Use manufacturer-recommended cold-expansion tool for ASTM F1960 connections.

D. Field Quality Control:
1. Do not expose PEX piping to direct sunlight for more than 30 days. If construction delays are encountered, provide cover to portions of piping exposed to direct sunlight.

E. Insulation:
1. All PEX-a piping is to be insulated. Refer to piping insulation spec section for additional information.

3.05 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:
1. Perform hydrostatic testing for leakage prior to system disinfection.
2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
3. Hydrostatic pressure testing shall be completed in accordance with local codes and the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition.

C. Gas Distribution Systems:
1. Test Preparation: Close each appliance valve or disconnect and cap each connected appliance.
2. General Systems:
   a. Inject a minimum of 10 psi of compressed air into the piping system for a duration of 15 minutes and verify with a gauge that no perceptible pressure drop is measured.
   b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound.
3. Welded Pipes or Systems with Service Pressures Above 14 in-wc:
   a. Inject a minimum of 60 psi of compressed air into the piping system for a duration of 30 minutes and verify with a gauge that no perceptible pressure drop is measured.
   b. Ensure test pressure gauge has a range of twice the specific pressure rate selected with an accuracy of 1/10 of 1 pound with 1 psi increments.

D. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with local code requirements and the Uponor PEX Piping Systems Design and Installation Manual (PDIM), current edition.

B. Prior to starting work, verify system is complete, flushed, and clean with potable water.

3.07 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.

END OF SECTION

SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water hammer arrestors.

B. Relief valves.

C. Air vents.

D. Floor drain trap seals.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata (2023).

B. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

C. NSF 372 - Drinking Water System Components - Lead Content; 2022.

D. PDI-WH 201 - Water Hammer Arresters; 2017.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

D. Manufacturer's qualification statement.

E. 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 Loose Keys for Outside Hose Bibbs: One.
   3. Extra Hose End Vacuum Breakers for Hose Bibbs: One.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors:
   1. Copper construction, piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range 34 to 250 degrees F and maximum 250 psi working pressure.

2.03 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.04 AIR VENTS

A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

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B. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
   2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

C. Washer Type:
   1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.05 FLOOR DRAIN TRAP SEALS

A. Manufacturers:

B. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping.

END OF SECTION

SECTION 22 1123
DOMESTIC WATER PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Circulators.

1.02 RELATED REQUIREMENTS

A. Section 25 3500 - Integrated Automation Instrumentation and Terminal Devices for HVAC.

1.03 REFERENCE STANDARDS

A. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide certified pump curve with duty point marked over pump and system operating conditions and NPSH curve and power requirement by pump tag.
   2. Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.

C. Shop Drawings: Include dimensions and performance data.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. 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 Pump Seals: One of each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing type of products specified in this section, with minimum three years of documented experience.

B. Certifications: Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc, as suitable for purpose specified and indicated.

C. Identification: Provide pumps with manufacturer's name, model number, and rated capacity identified by permanently attached label.

D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for circulators. Complete forms in Owner's name and register with manufacturer.

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PART 2 PRODUCTS

2.01 CIRCULATORS

A. Casing: Bronze with bronze cast impeller, and stainless steel rotor assembly.

B. Shaft: Alloy steel with integral thrust collar and two oil-lubricated bronze sleeve bearings.

C. Mechanical Seal: Carbon rotating against a stationary ceramic seat.

D. Pipe-End Connection: Union connection.

E. Maximum Discharge Pressure: 145 psi.

F. Motor: 1,750 rpm, ECM duty with flexible coupling.

G. Service Temperature Range: Minus 30 to 250 degrees F.

H. Controls: Provide aquastat set for high-temp cutoff, electric plug, and illuminated hand switch.

I. BMS or Other Integrated Automation Link: Provide auxiliary contacts for fault and run status.

J. Accessories: Include inlet-outlet temperature and pressure gauges with 2-way isolation valves.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products with related fittings, and accessories according to manufacturer instructions.

B. Potable and Drinking Water Service: Provide NSF 61 certified; comply with ICC (IPC).

C. Electrical-Driven Pump Work:
   1. Provide electric-motor-driven equipment specified complete with local disconnect switch and control panel with starter, controls, safety devices, and related wiring.
   2. Provide automatic control and protective devices field-wired to interface-related devices required for specified operation.

D. Ensure that small pressure gauges are installed on both upstream and downstream ends.

E. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are nonoverloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

F. Coordinate BAS, BMS, or Integrated Automation linking between unit controller and remote software app or terminal; see Section 25 3500.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.03 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

B. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

3.04 PROTECTION

A. Protect installed products from damage due from subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

END OF SECTION

SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

B. NSF 372 - Drinking Water System Components - Lead Content; 2022.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on-site in factory packaging. Inspect for damage.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for all plumbing fixtures.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Refer to contract documents for plumbing fixture specifications.

B. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

C. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

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3.03 INSTALLATION

A. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

B. Install components level and plumb.

C. Install and secure fixtures in place with wall supports and bolts.

D. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 CLEANING

A. Clean plumbing fixtures and equipment.

3.06 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 23 0010
GENERAL REQUIREMENTS FOR HVAC SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The General Requirements for Mechanical Work are intended to be complementary to the General Requirements of the Construction Contract.

B. Work Included: Provide complete mechanical systems where shown on the drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to the following summary of work:
   1. Provide new mechanical equipment as indicated and scheduled on the contract drawings.
   2. Provide new DDC controls for new equipment and integrate with the district central DDC system.
   3. Test & Balance: will be provided by the Owner. Contractor responsibilities to support the Test & Balance effort are contained in Section 23 05 93.
   4. Other items and services required to complete the systems.

1.02 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers that are thoroughly trained and experienced in the necessary crafts and are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Architect/Engineer/Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. Codes: Perform all work in accordance with the latest edition of the following codes:
   1. State and city building, fire, plumbing, and mechanical codes.
   2. National Electrical Code (NEC)
   3. National Fire Protection Association (NFPA)
   4. American with Disabilities Act (ADA)
   5. Texas Accessibility Standards (TAS)
   6. All authorities having jurisdiction.

D. Where conflicts occur between drawings, specifications, and code requirements, the most stringent requirement shall take precedence.

E. Standards: The specifications and standards of the following organizations are by reference made a part of these specifications. All work, unless otherwise indicated, shall comply with the requirements and recommendations wherever applicable:
   1. American National Standards Institute (ANSI)
   2. Air Conditioning and Refrigeration Institute (ARI)
   3. American Gas Association (AGA)
   4. American Society for Testing and Materials (ASTM)
   5. American Society of Plumbing Engineers (ASPE)
   6. American Society of Mechanical Engineers (ASME)
   7. American Society of Refrigeration, Heating and Air Conditioning Engineers (ASHRAE)
   8. Electrical Testing Laboratories (ETL)
   9. National Bureau of Standards (NBS)
   10. National Electrical Manufacturer's Association (NEMA)
   11. National Fire Protection Association (NFPA)
   12. Sheet Metal and Air Conditioning National Association (SMACNA)
   13. Underwriters Laboratories, Inc. (UL)

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F. Electrical Characteristics for Equipment: Equipment of differing electrical characteristics may be furnished provided such equipment is proposed on the “Alternate Manufacturer Evaluation Form”, subsequently approved, and connecting electrical services, circuit breakers, and conduit sizes appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

G. When requested, provide the Owner’s Authorized Representative with manufacturer’s certificate that materials meet or exceed minimum requirements as specified.

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. The requirements and recommendations of the latest edition of the Occupational Safety and Health Administration (OSHA) Act are by reference made a part of these specifications. All work shall comply with the requirements and recommendations wherever applicable.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. All Other Sections of Divisions 21, 22, and 26 (as applicable).

B. All other divisions of the contract documents. Refer to each division's specifications and drawings for all requirements

1.05 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Provide Specifications per Division 01 for all submitted alternate equipment.

C. Product Data: Submit the following:
1. Materials list of items proposed to be provided under Division 23.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.
3. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. All substitutions shall be approved in writing by Architect/Engineer. The Architect/Engineer’s decision shall be final.
4. Allow a minimum of ten (10) working days for the review of submittals and each re-submittal.
5. Compliance with the Contract documents shall be the sole responsibility of the Contractor. Items on equipment that are were not accepted by the Architect/Engineer in writing as an approved equal shall be replaced or revised to comply with the contract documents at the Contractor's expense.
6. Manufacturer's recommended installation procedures which, when reviewed by the Architect/Engineer, shall become the basis for accepting or rejecting actual installation procedures used on the work.
7. Sign the submittal as an indication of compliance with the contract documents. Any deviations from the contract documents shall be indicated on the submittal prior to signing. Any deviations not indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor’s expense.

D. See individual specification Sections for submittal requirements of materials and equipment.

E. Resubmittals of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor's disregard of Architect/Engineer's primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on Architect/Engineer's hourly rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus fifteen percent (15%).

F. Shop Drawings: Upon written request of the Contractor, the Architect/Engineer will provide directly to the Contractor electronic backgrounds of drawings required to produce shop drawings. The requirements to secure electronic files for shop drawing purposes are the same as for record drawing purposes. See 230010, Paragraph 1.15.H.2.

1.06 SUBSTITUTIONS

A. The use of manufacturers' names and catalog numbers followed by the phrase "or equal" is generally used to establish a standard of quality and utility for the specified items and to provide a dimensional reference for construction documents that are drawn to scale.

B. Submittals for "equal" items shall, where applicable, include the following data that are not necessarily required for specified items:
   1. Performance characteristics.
   2. Materials.
   3. Finish.
   4. Certification of conformance with specified codes and standards.
   5. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in Paragraph 6 below.
   6. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/ Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Include shop drawings for all piping and ductwork equipment per Paragraph 1.5 Submittals. Organize in a clear and concise format.

C. Submittals of "equal" components or systems may be rejected if:
   1. The material or equipment would necessitate the alteration of any portion of the mechanical, electrical, architectural or structural design.
   2. Dimensions vary from the specified material or equipment in such a manner that accessibility or clearances are impaired or the work of other trades is adversely affected.

D. Proposed substitutions for materials or equipment must be submitted ten (10) days prior to final bid date for consideration as approved equals. Otherwise, such substitutions will not be permitted. Only Prime Bidders are allowed to make proposals for substitutions. Manufacturers, distributors, and sub-contractors shall not make proposals to the Architect/Engineer for substitutions.

E. No substitution shall be made unless authorized in writing by the Architect/Engineer. Should a substitution be accepted, and should the substitute material prove defective or otherwise unsatisfactory for the service intended, and within the guarantee period, replace this material or equipment with material or equipment specified, at no additional cost to the Architect/Engineer/Owner, and to the satisfaction of the Architect/Engineer.

F. Contractors submitting bids on substitute materials and equipment must also provide a written performance guarantee certifying that the substitute materials and equipment will produce the specified effects and meet the approval of the Architect/Engineer.

1.07 ORDINANCES, PERMITS, METERS, UTILITIES, AND ROYALTIES

A. Procure all permits and licenses necessary for completion of this project and pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. All required certificates of approvals and inspections by local governing and regulating authorities shall be obtained and paid for by the Contractor.

B. Pay all fees required for the connection of water, gas, and sewer to utility mains, and any meter fees if required.

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1. Pay any royalty payments required or fees for the use of patented equipment or systems. Defend all law suits or claims for infringement of any patent rights and shall hold the Owner and Architect/Engineer harmless from loss as a result of said suits or claims.

1.08 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for satisfactory operation of all component parts of the mechanical systems to assure compatibility of all equipment and performance of the integrated systems in accordance with the requirements of the specifications. Should the Contractor consider any part of the specifications or drawings as rendering his acceptance of such responsibility impossible, prohibitive, or restrictive, he shall notify the Architect/Engineer before submitting his bid, and the bid shall be accompanied by a written statement of any objections or exceptions to the specifications and drawings.

1.09 EXISTING UTILITIES AND TEMPORARY SERVICES FOR CONSTRUCTION

A. Verify the location and capacity of existing utility services pertaining to work of Division 23. Relocate existing utilities unearthed by excavation as directed by the utility service companies affected.

B. Temporary Services for Construction
   1. Provide temporary services in strict accordance with the provisions of these specifications.

1.10 EXCAVATION AND BACKFILLING

A. Perform all excavation and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them in dry condition until the work has been installed. Properly perform all shoring required to protect the excavation and to safeguard employees.

B. Perform excavation and backfilling in strict accordance with the provisions of these specifications including trench safety requirements.

C. Make all excavations to the proper depth, with allowances made for floor slabs, forms, beams, etc. Properly compact ground under piping before installing piping.
   1. Provide backfilling with selected soil, free from rocks and debris and pneumatically tamp with 6-inch layers to secure a field density ration of 95 percent as defined by ASTM Designation D698-57T (Proctor Soil Compaction Test).

D. Remove from the site excavated materials not suitable and not used in the backfill.

E. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, repair them at no cost to the Architect/Engineer/Owner.

F. In a lime-stabilized area, fully restore the lime stabilization after the excavation is complete.

G. Replace concrete, curbs, paving, and other surface improvements cut during excavation to their original condition.

1.11 JOBSITE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Include required work to correct conditions detrimental to the timely and proper completion of all Division 23 Work. Do not proceed until unsatisfactory conditions are corrected.

1.12 PREPARATION AND COORDINATION

A. Perform coordination work in strict accordance with provisions of these specifications and the following:
   1. Coordinate as necessary with other trades to assure proper and adequate interface with all work.
   2. Where ducts, pipes and other mechanical items are shown in conflict with locations of structural members and other equipment, include labor and materials required for extensions, offsets and supports to clear the encroachment.

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3. Although such work is not specifically indicated, provide all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.
4. Coordinate accepted equipment changes from those scheduled or specified with other trades affected. Additional compensation to other trades for equipment changes is the responsibility of the Contractor making the change.

B. Mechanical Drawings are diagrammatic. Follow the drawings as closely as actual construction and work of other trades will permit. Duct and piping arrangement have been designed for maximum economy consistent with good practice and other considerations. Install the systems arranged as shown on the drawings, except as otherwise approved in advance by the Architect/Engineer.

C. Data indicated on the Drawings and in these Specifications are as exact as could be secured, but their absolute accuracy is not warranted. The exact locations, distances, levels, and other conditions will be governed by actual construction and the Drawings and Specifications should be used only for guidance in such regard.

D. Where items such as diffusers, thermostats, switches, and control panels are not specifically located on the Drawings, provide an RFI to the Architect/Engineer, and locate as determined in the field by the Architect/Engineer. Where such items are installed without such specific direction, relocate as directed by the Architect/Engineer, and at no additional cost to the Architect/Engineer/Owner.

E. Verify all dimensions and distances. No additional compensation will be allowed because of differences between work shown on the Drawings and actual dimensions and distances at the jobsite.

1.13 CONSTRUCTION REQUIREMENTS

A. The drawings show the arrangements of work. Should project conditions necessitate rearrangement, or if the materials or equipment can be installed to a better advantage in a different manner, before proceeding with the work, prepare and submit five copies of Drawings of the proposed arrangement for the Architect/Engineer’s review. Allow a minimum of ten (10) working days for review.

B. Should the Contractor propose to install equipment requiring space conditions other than those shown, or rearrange the equipment, he shall assume responsibility for the rearrangement of the space and shall have the Architect/Engineer review the change before proceeding with the work. The request for such changes shall be accompanied by contractor-generated detailed shop drawings of the space in question. Identify monetary credits proposed or other benefits of the change. Allow a minimum of ten (10) working days for review.

C. Properly locate and size all slots, holes, and openings in the building structure pertaining to the work and for the correct location of pipe sleeves, duct sleeves, fire dampers, etc., as applicable to the work.

1.14 CUTTING AND PATCHING

A. Perform cutting and patching associated with the work in strict accordance with the provisions of Division 01 of these Specifications and the following:
1. Coordinate work to minimize cutting and patching work.
2. Request for Architect/Engineer's Consent
   a. Prior to cutting or coring of the building structure, submit a written request to the Architect/Engineer for permission to proceed with cutting. Include x-rays of any floor area where cutting or coring is proposed.
   b. Contractor is cautioned that concrete floor may contain steel tendons, pipes, and electrical/telecom conduits, all of which can not be cut or damaged.
3. Perform Architect/Engineer-approved cutting and demolition by methods that will prevent damage to other portions of the work and provide proper surfaces to receive installation of new work and repair.

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4. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.
5. Provide all core drilling of holes. Where sleeves and blockouts are required, they shall be cut or provided at locations required. On completion of this work or as work progresses, make all repairs and do all patching required as a result of work under this Contract. All patching shall be performed in a manner that will restore the surrounding work to its original condition to the satisfaction of the Architect/Engineer.
6. Assume responsibility for the proper size of all sleeves and blockouts in the building structure pertaining to the work and for providing the correct location of pipe sleeves and blockouts.
7. Where openings are cut through masonry walls, provide lintels or structural supports to protect the remaining masonry. Provide adequate support during the cutting operation to prevent any damage to the affected masonry.

1.15 PROJECT RECORD DOCUMENTS

A. Provide the record documents associated with the work of Division 23 in strict accordance with the provisions of these specifications.

B. Throughout progress of the Division 23 Work, maintain an accurate record of changes in the Contract Documents that apply to work of Division 23. Changes shall include all addendums issued during bidding. Maintain an accurate record of the location of mechanical service lines and outlets and all outside utilities.

C. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Architect/Engineer. Submit in writing at the pre-construction conference the name and credentials of the person responsible for record mark-ups and maintenance.

D. Accuracy of Records
1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of drawings and other documents where such entry is required to show the change properly. Match the symbology and format of the base documents.
2. Accuracy of records shall be such that a future verification of items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

E. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final Project Record Documents.

F. Making Entries on Drawings
1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
2. Date all entries.
3. Call attention to the entry by a "cloud" drawn around the area or areas affected.
4. In the event of overlapping changes, use different colors for the overlapping changes.
5. Make entries within 24 hours after receipt of information that the change has occurred.
6. Maintain the base drawing format and use the same symbology.
7. Convert field mark-ups to finished CADD record drawings when required in this section.

G. Conversion of Schematic Layouts
1. In some cases on the drawings, arrangements of ductwork and piping and similar items are shown schematically and are not intended to portray precise physical layout. Determine final physical arrangement subject to the Architect/Engineer's approval. However, design of future modifications of the facility may require accurate information as to the final physical layout of items that are shown only schematically on the drawings.

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2. Show on the job set of record drawings, by dimension accurate to within one inch, the centerline of each run of items such as all sleeves and piping, etc., below grade, in walls, or in the concrete slab. A surface mounted device indicates the exact location:
   a. Clearly identify the item by accurate note such as "Chilled Water" and the like.
   b. Show, by symbol or note, the vertical location of the item "under slab," "in ceiling plenum," "exposed," and the like.
   c. Make all identification sufficiently descriptive that it may be related reliably to the specifications.

H. Final Project Record Documents
1. The purpose of the final Project Record Documents is to provide factual
   a. information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.
2. Provide completed record drawings on CD and one Mylar film reproducible of each drawing.
3. Refer to Section 017839 for additional requirements.

1.16 OPERATION AND MAINTENANCE DATA

A. Well before substantial completion, submit two copies of a preliminary draft of the proposed manual(s) to the Architect/Engineer for review and comments. Allow a minimum of ten (10) working days for review.

B. Submit specified number copies of the approved manual to the Architect/Engineer prior to indoctrination of operation and maintenance personnel.

C. Prepare in accordance with the following standards:

Format:	8½" x 11"
Size:	White bond, at least 20 lb. weight
Paper:	Neatly written or printed
Text:	11" in height preferable; bind in with text; foldouts acceptable; larger drawings are acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.
Drawings:	Separate each section of the Manual with neatly prepared flysheets briefly describing contents of the ensuing section; flysheets may be in color.
Flysheets:	Use heavy-duty plastic or fiberboard covers with binding mechanism concealed inside the manual; 3-ring binders will be
Binding:	

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	acceptable; all binding is subject to the Architect/ Engineer's approval.
Measurements:	Provide all measurements in U.S. standard units such as feet-and-inches, lbs, and cfm. Where items may be expected to be measured within ten years in accordance with metric formulae, provide additional measurements in the "International System of Units" (SI).

D. Provide front and back covers for each manual, using durable material approved by the Architect/Engineer, and clearly identified on or through the cover with at least the following information:
   1. Name and Address of Work
   2. Name of Contractor
   3. General subject of this manual
   4. Space for approval signature of the Architect/Engineer and approval date

1.17 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contents: Include at least the following:
   1. Neatly typewritten index near the front of the manual, giving immediate information as to location within the manual of all emergency information regarding the installation.
   2. Complete instructions regarding operation and maintenance of all equipment provided including lubrication, disassembly, and reassembly.
   3. Complete nomenclature of all parts of all equipment.
   4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.
   5. Copy of all guarantees and warranties issued.
   6. Manufacturer's bulletins, drawings, and descriptive data, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
   7. Such other data as required in other sections of these specifications.

1.18 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations associated with the work in accordance with the provisions of these specifications

B. Provide concrete bases for all pad or floor mounted equipment. Bases shall be four inches (4”) high above finished floors or grades (unless otherwise noted) and shall protrude two inches (2”) beyond all sides of equipment and shall have exposed chamfer edges. Construct bases from ready-mixed hardrock concrete, ASTM C94, reinforced with #3 rebar, ASTM A615, Grade 40, at 18” on center each way.

C. Field verify exact location of outdoor pad mounted equipment with the Architect/Engineer. Supply necessary fill and grade site to provide natural drainage away from equipment.

1.19 PAINTING

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be damaged in transit or during the installation, it shall be finished to match appearance of original finish. All work shall be subject to approval by Architect/Engineer.

1.20 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from the Architect/Engineer and governmental agencies having jurisdiction.

B. Make written notice to the Architect/Engineer, adequately in advance, of each of the following stages of construction:
   1. When all rough-in is complete, but not covered;
   2. As specified in all Division 23 sections.
   3. At the completion of the work of Division 23.

C. When material or workmanship is found to not comply with the specified requirements, remove the noncomplying items from the job site and replace them with items complying with the specified requirements at no additional cost to the Architect/Engineer/Owner. This shall be performed within 3 days after receipt of written notice of noncompliance.

1.21 WARRANTY

A. Warranty all equipment and workmanship for a period of one year after date of substantial completion and replace or repair any faulty equipment or installation at no cost to the Architect/Engineer/Owner for such service during this period, all in accordance with requirements of Division 01.

B. Provide full material warranty on all compressors for a period of five years after date of substantial completion.

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. Warranties shall be in writing in a form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

1.22 PROJECT COMPLETION

A. Upon completion of the work of Division 23, thoroughly clean all exposed portions of the mechanical installation, removing all traces of soil, labels, grease, oil, and other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned.

END OF SECTION

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SECTION 230400
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 013000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.

B. Section 016000 - 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 013000 - 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 adustments 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.

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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 hazzards that require fall protection by state or local codes.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 23 0517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe-sleeve seals.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum _____ experience.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 2 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

C. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

D. Clearances:

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1. Provide allowance for insulated piping.
2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Modular Mechanical Sleeve-Seal:
   1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
   3. Size and select seal component materials in accordance with service requirements.
   4. Glass-reinforced plastic pressure end plates.

B. Sealing Compounds:
   1. Provide packing and sealing compound to fill pipe to sleeve thickness.
   2. Combined packing and seal compound is to match partition fire-resistance hourly rating.

C. Pipe Sleeve Material:
   1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
   2. Masonry Structures: Sheet metal or fiber.

D. Wall Sleeve: PVC material with waterstop collar, and nailer end-caps.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, floors, walls, partitions, and roofs. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
   2. Aboveground Piping:
      a. Pack solid using mineral fiber in compliance with ASTM C592.
      b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
   3. All Rated Openings: Caulk tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.
   4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. Manufactured Sleeve-Seal Systems:
   1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
   2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
   3. Locate piping in center of sleeve or penetration.
   4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
   5. Tighten bolting for a water-tight seal.
   6. Install in accordance with manufacturer's recommendations.

H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

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SECTION 23 0529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2023.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

E. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

G. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

J. FM (AG) - FM Approval Guide; Current Edition.

K. MFMA-4 - Metal Framing Standards Publication; 2004.

L. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

M. UL (DIR) - Online Certifications Directory; Current Edition.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

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5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, and thermal insulated pipe supports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Prefabricated Trapeze-Framed Metal Strut Systems:
   1. MFMA-4 compliant, pre-fabricated, MSS SP-58 type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
   2. Strut Channel or Bracket Material:
      a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
   3. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
   4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
   5. Accessories: Provide bracket covers, cable basket clips, cable tray clips, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

C. Strut Channels:
   1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
   2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

D. Channel Nuts:

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1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring.

E. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Piping up to 1 inch: 1/4 inch diameter.
   c. Piping larger than 1 inch: 3/8 inch diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

F. Thermal Insulated Pipe Supports:
1. General Requirements:
   a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
   c. Pipe supports to be provided for nominally sized, 1/2 to 30 inch iron pipes.
   d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
2. PVC Jacket:
   a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
   b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
   c. Thickness: 60 mil.
3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

G. Pipe Supports:
1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up To 122 degrees F:
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
   b. Support From Below: MSS SP-58 Types 35 through 38.
3. Operating Temperatures from 122 to 446 degrees F:
   a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
   b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.

H. Beam Clamps:
1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with stainless steel and zinc finish.
3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with zinc finish. For inverted usage provide manufacturer listed size(s).
4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with zinc finish.
5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with zinc finish.
6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plated finish,
7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

I. Riser Clamps:

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1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, stainless steel, or zinc plated finish.
3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, stainless steel, or zinc plated finish.
4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.

J. U-Bolts:
1. MSS SP-58 Type 24, carbon steel u-bolt for pipe support or anchoring.

K. Strut Clamps:
1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.

L. Insulation Clamps:
1. Two bolt-type clamps designed for installation under insulation.
2. Material: Carbon steel with epoxy copper or zinc finish.

M. Pipe Hangers:
1. Clevis Hangers, Adjustable:
   a. Light-Duty: MSS SP-58 Type 1, zinc-plated.
   b. Standard-Duty: MSS SP-58 Type 1, zinc-plated.

N. Intermediate Pipe Guides:
1. Pipe Diameter 6 inch and Smaller: Provide minimum clearance of 0.16 inch.
2. Pipe Sizes 8 inch: 0.625 inch U-bolt with double nuts providing minimum clearance of 0.28 inch.
3. Pipe Size 10 inch: 0.75 inch U-bolt.
4. Pipe Sizes 12 to 16 inch: 0.875 inch U-bolt.
5. Pipe Sizes 18 to 30 inch: 1 inch U-bolt.
6. Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.

O. Pipe Alignment Guides: Galvanized steel.
1. Pipe Sizes 8 inch and Smaller: Spider or sleeve type.
2. Pipe Sizes 10 inch and Larger: Roller type.

P. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

Q. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

R. Pipe Shields for Insulated Piping:
1. General Construction and Requirements:
   a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
   b. Shields Material: UV-resistant polypropylene with glass fill.
   c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
   d. Minimum Service Temperature: Minus 40 degrees F.

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e. Maximum Service Temperature: 178 degrees F.
f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

S. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.
7. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, stainless steel, or zinc finish.
8. Sheet Metal: Use sheet metal screws.
9. Wood: Use wood screws.
10. Plastic and lead anchors are not permitted.
11. Powder-actuated fasteners are not permitted.
12. Hammer-driven anchors and fasteners are not permitted.
13. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Comply with MFMA-4.
b. Channel Material: Use galvanized steel.
c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

H. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

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3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Pipe markers.

E. Ceiling tacks.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Equipment: Nameplates.

B. Air Terminal Units: Tags.

C. Control Panels: Nameplates.

D. Ductwork: Adhesive-backed duct markers.

E. Piping: Pipe markers.

F. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch.

C. Background Color: Black.

D. Nameplate Material:
   1. Flexible: Vinyl with adhesive backing per ASTM D709.
   2. Metal: Brass with center-side holes for screw fastening.

2.03 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges and corrosion-resistant ball ch.

B. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

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B. Label Content: Include identification of duct service using same designations or abbreviations used on Drawings, and arrow indicating flow direction.
   1. Flow Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as a separate unit on each duct label to indicate flow direction.
   2. Lettering Size: 1-1/2 inch minimum.

C. Style: Individual Label.

D. Color: Green/White.

2.05 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Underground Plastic Pipe Markers: Bright-colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

D. Color code as follows:
   1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Fire Dampers and Smoke Dampers: Red.
   3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install ductwork with adhesive-backed duct markers. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 01 9113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

B. Section 23 0800 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Submit to the Commissioning Authority.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   4. Include at least the following in the plan:
      a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      e. Final test report forms to be used.
      f. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Terminal flow calibration (for each terminal type).
         2) Diffuser proportioning.
         3) Branch/submain proportioning.
         4) Total flow calculations.
         5) Rechecking.
         6) Diversity issues.
      g. Details of how TOTAL flow will be determined; for example:
         1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
         2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

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h. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
i. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least once a week to the Commissioning Authority.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in I-P (inch-pound) units only.
8. Include the following on the title page of each report:
a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Report date.

F. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

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1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
   a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
   b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place.
   15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

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C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

N. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

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D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 COMMISSIONING

A. See Sections 01 9113 - General Commissioning Requirements and 23 0800 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:
   1. Air side systems.
   2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check a random sample equivalent to 10 percent of the final TAB report data as directed by Commissioning Authority.
   1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
   2. Use the same test instruments as used in the original TAB work.
   3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
   4. For purposes of re-check, failure is defined as follows:
      a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
      b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
      c. Temperatures: Deviation of more than one degree F.
      d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
      e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
   5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:
   1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
   2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
   3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

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3.09 SCOPE

A. Test, adjust, and balance the following:
   1. HVAC Pumps.
   2. Packaged Steel Water Tube Boilers.
   3. Forced Air Furnaces.
   4. Air Cooled Water Chillers.
   5. Packaged Roof Top Heating/Cooling Units.
   6. Computer Room Air Conditioning Units.
   7. Air Handling Units.
   8. Fans.
   9. Air Terminal Units.
   10. Air Inlets and Outlets.

3.10 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer.
   2. Model/Frame.
   3. HP/BHP.
   4. Phase, voltage, amperage; nameplate, actual, no load.
   5. RPM.
   6. Service factor.
   7. Sheave Make/Size/Bore.

B. Pumps:
   1. Identification/number.
   2. Manufacturer.
   3. Size/model.
   4. Impeller.
   5. Service.
   6. Design flow rate, pressure drop, BHP.
   7. Actual flow rate, pressure drop, BHP.
   8. Total operating head pressure.
   9. Shut off, discharge and suction pressures.

C. Combustion Equipment:
   1. Boiler manufacturer.
   2. Model number.
   3. Serial number.
   4. Firing rate.
   5. Overfire draft.
   6. Gas pressure at meter outlet.
   7. Gas flow rate.
   8. Heat input.
   9. Heat output.

D. Chillers:
   1. Identification/number.
   2. Manufacturer.
   3. Capacity.
   4. Model number.
   5. Serial number.
   6. Evaporator entering water temperature, design and actual.
   7. Evaporator leaving water temperature, design and actual.
   8. Evaporator pressure drop, design and actual.
   9. Evaporator water flow rate, design and actual.

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10. Condenser entering water temperature, design and actual.
11. Condenser pressure drop, design and actual.
12. Condenser water flow rate, design and actual.

E. Cooling Coils:
1. Identification/number.
2. Location.
3. Service.
4. Air flow, design and actual.
5. Entering air DB temperature, design and actual.
6. Entering air WB temperature, design and actual.
7. Leaving air DB temperature, design and actual.
8. Leaving air WB temperature, design and actual.
9. Water flow, design and actual.
10. Water pressure drop, design and actual.
11. Entering water temperature, design and actual.
12. Leaving water temperature, design and actual.
13. Air pressure drop, design and actual.

F. Heating Coils:
1. Identification/number.
2. Location.
3. Service.
4. Air flow, design and actual.
5. Water flow, design and actual.
6. Water pressure drop, design and actual.
7. Entering water temperature, design and actual.
8. Leaving water temperature, design and actual.
9. Entering air temperature, design and actual.
10. Leaving air temperature, design and actual.
11. Air pressure drop, design and actual.

G. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Sheave Make/Size/Bore.
11. Number of Belts/Make/Size.
12. Fan RPM.

H. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Sheave Make/Size/Bore.
8. Number of Belts/Make/Size.

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9. Fan RPM.

I. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.

J. Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure.

K. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Design air flow.
6. Test (final) air flow.
7. Percent of design air flow.

END OF SECTION

SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

E. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2025.

F. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers; 2015 (Reapproved 2022).

G. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

K. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

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1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K value: 0.27 at 75 degrees F, when tested in accordance with ASTM C518.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

E. Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Density: 2.0 pcf.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

D. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
   2. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.04 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board. Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1,700 deg. F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

B. Fire-Rated Blanket. High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

2.05 JACKETING AND ACCESSORIES

A. Aluminum Jacket:

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1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
2. Thickness: 0.016 inch sheet.
3. Finish: Smooth.
4. Joining: Longitudinal slip joints and 2 inch laps.
5. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
6. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

B. Flexible Weather-Proofing Outdoor Jacket: Self-healing, field-applied outdoor cladding.
1. Material: Aluminum foil/polymer laminate with rubberized asphalt layer and acrylic adhesive.
2. Thickness: 34 mil, 0.034 inch.
3. Finish: Embossed.
4. Color: Silver.
5. Water Vapor Transmission: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
6. Mold Resistance: Pass when tested in accordance with ASTM C1338.
7. Emissivity: 0.30 when tested in accordance with ASTM C1371.

C. Reinforced Tape:
1. FSK tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
2. Comply with UL 723 or ASTM E84.
3. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.
4. Finish: Match insulation.

2.06 DUCT LINER

A. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
1. Fungal Resistance: No growth when tested according to ASTM G21.
2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
3. Service Temperature: Up to 250 degrees F.
4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
2. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

D. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with aluminum jacket.

E. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with outdoor jacket finished as specified in Section 2.05 Jackets.

F. Slope exterior ductwork to shed water.

G. External Duct Insulation Application:

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1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

H. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft of Exterior Openings:
1. Type: Mineral Fiber Blanket
2. Thickness: 2 inch or as required to meet installed R-value of 6.0

B. Supply, Return and Outside Air Ducts:
1. Type: Mineral Fiber Blanket (Concealed)
2. Thickness: 2 inch or as required to meet installed R-value of 6.0

C. Ducts Exposed to Outdoors:
1. Type: Mineral Fiber Board with field applied jacket
2. Thickness: 3 inch or as required to meet installed R-value of 8.0

D. Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum:
1. Type: Fire-rated blanket or board
2. Thickness: As required to achieve 2-hour fire rating

E. Duct Liner:
1. Location: All exposed ductwork and first 15' at equipment connection.
2. Type: Glass Fiber Insulation
3. Thickness: 1 1/2" or as required to meet installed R-value of 6.0

END OF SECTION

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SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Weather barrier coatings.

D. Jacketing and accessories.

E. Engineered wall outlet seals and refrigerant piping insulation protection.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019, with Editorial Revision (2023).

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2019).

E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

H. ASTM D610 - Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces; 2008 (Reapproved 2019).

I. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

L. 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).

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 2023).

N. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

O. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

P. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

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Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 850 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. Maximum Service Temperature: 650 degrees F.
   2. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

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C. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.

2.04 WEATHER BARRIER COATINGS

A. Weather-Resistive Barrier Coating: Fire-resistive, UV resistant, water-based mastic for use over closed cell polyethylene and polyurethane foam insulation; applied with glass fiber or synthetic reinforcing mesh.
   1. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
   2. Water Vapor Permeance: Greater than 1.0 perm in accordance with ASTM E96/E96M.
   3. Resistance to Fungal Growth: No growth when tested in accordance with ASTM D5590.
   4. Color: As selected by Architect.

2.05 JACKETING AND ACCESSORIES

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch.
      e. Connections: Brush on welding adhesive.

B. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch sheet.
   3. Type: Factory-applied, self-adhesive jacketing.
   4. Finish: Embossed.
   5. Joining: Longitudinal slip joints and 2 inch laps.
   6. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
   7. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.06 ENGINEERED WALL OUTLET SEALS AND REFRIGERANT PIPING INSULATION PROTECTION

A. Basis of Design: Airex Manufacturing, Inc.
   1. Pipe Penetration Wall Seal: Airex Titan Outlet.
   2. Refrigeration Pipe Insulation Protection System: Airex E-Flex Guard.

B. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
   1. Outlet Cover Color: As selected by Architect.
   2. Water Penetration: Comply with ASTM E331.
   3. Air Leakage: Comply with ASTM E283.
   4. Air Permeance: Comply with ASTM E2178.

C. Insulation Protection System: Refrigerant piping insulation PVC protective cover.
   1. PVC Insulation Cover Color: Black with full-length velcro fastener.
   2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
   3. Water/Vapor Permeability: Comply with ASTM E96/E96M.
   4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.
   5. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.

2.07 ACCESSORIES

A. General Requirements:

1. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
2. Comply with ASTM C795 requirements for materials to be used on stainless steel surfaces.
3. Supply materials that are asbestos free.

B. Corrosion Inhibitors:
1. Corrosion Control Gel:
a. Corrosion Protection: Comply with ASTM B117 and ASTM D610.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

G. Inserts and Shields:
1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 07 8400.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

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K. Buried Piping: Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.

L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 SCHEDULE

A. Heating Systems:
   1. Heating Water Supply and Return:
      a. Indoor Applications:
         1) NPS 1-1/2 inch and smaller: Preformed glass fiber, 1-1/2 inch thick
         2) NPS 2 and larger: Preformed glass fiber, 2 inch thick
      b. Outdoor Applications:
         1) All sizes: Preformed glass fiber, 2 inch thick with field applied jacket

B. Cooling Systems:
   1. Chilled Water:
      a. Indoor Applications:
         1) All sizes: Preformed glass fiber, 1-1/2 inch thick
      b. Outdoor Applications:
         1) All sizes: Preformed glass fiber, 2 inch thick with field applied jacket
   2. Refrigerant Suction and Hot Gas:
      a. Indoor Applications:
         1) All sizes: Flexible elastomeric, 1 inch thick
      b. Outdoor Applications:
         1) All sizes: Flexible elastomeric, 2 inch thick

END OF SECTION

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SECTION 23 0800
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. See Section 01 9113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 01 9113.

B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
   1. Control system.
   2. Major and minor equipment items.
   3. Piping systems and equipment.
   4. Ductwork and accessories.
   5. Terminal units.
   6. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process; 2007, with Errata (2012).

1.04 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. Draft Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:
   1. System name.
   2. List of devices.
   3. Step-by-step procedures for testing each controller after installation, including:
      a. Process of verifying proper hardware and wiring installation.
      b. Process of downloading programs to local controllers and verifying that they are addressed correctly.
      c. Process of performing operational checks of each controlled component.
      d. Plan and process for calibrating valve and damper actuators and all sensors.
      e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.
   4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.

5. Description of the instrumentation required for testing.
6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
2. Full as-built set of control drawings.
3. Full as-built sequence of operations for each piece of equipment.
4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
   a. Floor.
   b. Room number.
   c. Room name.
   d. Air handler unit ID.
   e. Reference drawing number.
   f. Air terminal unit tag ID.
   g. Heating and/or cooling valve tag ID.
   h. Minimum air flow rate.
   i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
6. Full as-built print out of software program.
7. Electronic copy on disk of the entire program for this facility.
8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
10. Control equipment component submittals, parts lists, etc.
11. Warranty requirements.
12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    a. Sequences of operation.
    b. Control drawings.
    c. Points lists.
    d. Controller and/or module data.
    e. Thermostats and timers.
    f. Sensors and DP switches.
    g. Valves and valve actuators.
    h. Dampers and damper actuators.
    i. Program setups (software program printouts).

E. Project Record Documents: See Section 01 7800 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan: In addition to requirements specified in Section 01 7900, include:
   1. Follow the recommendations of ASHRAE Guideline 1.1.
   2. Control system manufacturer's recommended training.
   3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals: See Section 01 7900 for additional requirements.
   1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
   1. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with Contract Documents.
   1. Provide a pressure/temperature plug at each water sensor that is an input point to the control system.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
2. Set pump/fan to normal operating mode.
3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
4. Command valve/damper open; verify position is full open and adjust output signal as required.
5. Command valve/damper to a few intermediate positions.
6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

E. Isolation Valve or System Valve Leak Check: For valves not by coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.

1. Setpoint changing features and functions.
2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:
1. That all specified functions and features are set up, debugged and fully operable.
2. That scheduling features are fully functional and setup, including holidays.
3. That all graphic screens and value readouts are completed.
4. Correct date and time setting in central computer.
5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
7. Power failure and battery backup and power-up restart functions.
8. Global commands features.
9. Security and access codes.
10. Occupant over-rides (manual, telephone, key, keypad, etc.).
11. O&M schedules and alarms.
12. Occupancy sensors and controls.
13. Fire alarm interlocks and response.
14. That points that are monitored only, having no control function, are reporting properly to the control system.
15. All control strategies and sequences not tested during controlled equipment testing.

H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 7800 for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. See Section 01 7900 for additional requirements.

B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

E. TAB Review: Instruct Owner's personnel for minimum eight hours, after completion of TAB, on the following:

1. Review final TAB report, explaining the layout and meanings of each data type.
2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
5. Other salient information that may be useful for facility operations, relative to TAB.

F. HVAC Control System Training: Perform training in at least three phases:
   1. Phase 1 - Basic Control System: Provide minimum of eight hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
      a. This training may be held on-site or at the manufacturer's facility.
      b. If held off-site, the training may occur prior to final completion of the system installation.
      c. For off-site training, Contractor shall pay expenses of up to two attendees.
   2. Phase 2 - Integrating with HVAC Systems: Provide minimum of eight hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
      a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
      b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
      c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.
      d. Every display screen, allowing time for questions.
      e. Point database entry and modifications.
   3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of eight hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.

G. Provide the services of manufacturer representatives to assist instructors where necessary.

H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

SECTION 23 0913
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Control panels.

B. Control Valves:
   1. Ball valves with factory-mounted actuators.
   2. Butterfly valves with factory-mounted actuators.
   3. Electronic valve operators.

C. Pressure independent valves and actuators.

D. Dampers.

E. Damper Operators:
   1. Electric operators.
   2. Inlet vane operators.

F. Wall-, Surface-, and Duct-Mounted Sensors:
   1. Temperature sensors.
   2. Humidity sensors.
   3. IAQ (indoor air quality) sensors.
   4. Building static pressure transmitters.
   5. Static air pressure sensors.
   6. Air pressure transmitters.
   7. Damper position indicators.
   8. Carbon monoxide sensors.
   9. Carbon dioxide sensors.

G. Thermostats:

H. Time switches.

I. Fan and pump motor run-status monitoring.

J. Pipe-Mounted Sensors and Transmitters:
   1. Temperature sensors.
   2. Differential pressure transmitters.
   3. Flow switches.
   4. Turbine/impeller flow meters.

K. Energy Metering:
   1. Hydronic energy meters.

1.02 RELATED REQUIREMENTS

A. Section 25 3513 - Integrated Automation Actuators and Operators.

B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

C. Section 26 2726 - Wiring Devices: Elevation of exposed components.

1.03 REFERENCE STANDARDS

A. ANSI/FCI 70-2 - Control Valve Seat Leakage; 2021.

B. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata (2023).

C. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

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E. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

F. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. Provide common keying for all panels.

2.03 CONTROL VALVES

A. Ball Valves with Factory-Mounted Actuators:
1. Service: Use for chilled water or hot water.
2. Flow Characteristic: Include 2-way and 3-way diverting operation configured to fail as indicated on drawings.
3. Replacements in Kind: Provide pressure-independent type.
4. Rangeability: 500 to 1.
5. ANSI Rating: Class 150.
6. Leakage: Class IV (0.1 percent of rated capacity) per ANSI/FCI 70-2.
7. Body Size:
   a. Under 2-1/2 inches:
      1) Connection: NPT.
      2) Materials:
         (a) Body: Brass.
         (b) Flanges: Ductile iron.
         (c) Ball: 300 series stainless steel.
         (d) Stem: 300 series stainless steel.
         (e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
         (f) Stem Seal: EPDM O-Rings.
         (g) Flow Control Disk: Thermoplastic synthetic-resin.
   b. 2-1/2 inches and Above:
      1) Connection Type: Flanged.
      2) Materials:
         (a) Body: Brass.
         (b) Flanges: Ductile iron.
         (c) Ball: 300 series stainless steel.
         (d) Stem: 300 series stainless steel.
         (e) Seat: Graphite-reinforced PTFE with EPDM O-Ring backing.
         (f) Stem Seal: EPDM O-Rings.
         (g) Flow Control Disk: Thermoplastic synthetic-resin.

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c. Service Temperature:
1) Fluid Side: 0 to 284 degrees F liquid or 25 psig steam.
2) Ambient Side: From minus 4 to 122 degrees F.

8. Actuator Requirements:
a. Assembly: Field-mounted.
b. Input: 0 to 10 VDC configured as indicated on drawings.
c. Accessories: Provide with valve position indicator and manual override.

B. Butterfly Valves with Factory-Mount Actuators:
1. Iron body, stainless steel disc, resilient replaceable seat for service to 250 degrees F wafer or lug ends, extended neck.
2. Hydronic Systems:
a. Rate for service pressure of 125 psig at 250 degrees F.
b. Size for 1 psig maximum pressure drop at design flow rate.

C. Electronic Valve Actuators:
1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.

2.04 PRESSURE INDEPENDENT VALVES AND ACTUATORS

A. Size 2 inch and Smaller:
1. Provide ball style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
2. Metal construction materials consist of bronze or brass.
3. Nonmetal construction materials consist of Teflon, EPDM, or engineered resin.

B. Size 2.5 inch and Larger:
1. Provide ball, globe, or butterfly style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, NORYL, or engineered resin.

C. Actuator Requirements:
1. Assembly: Field-mounted.
2. Input: 0 to 10 VDC configured as indicated on drawings.
3. Accessories: Provide with manual override and valve position indicator.

2.05 DAMPERS

A. See Section 23 3300 for dampers and this section for actuators and operators.

2.06 DAMPER OPERATORS

A. General:
1. Provide actuators with torque capacity sized for minimum of 20 percent greater than maximum design stream velocity and hold tight seal against maximum system pressures.
2. Provide spring return for two position control and for fail safe operation.
3. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.
4. Provide one operator for maximum 36 sq ft damper section.
5. See Section 25 3513 for field-mount damper actuators and operators.

B. Electric Operators:
1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

C. Inlet Vane Operators:

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1. High pressure with pilot positioners and sufficient force to move vanes when fan is started with vanes in closed position. Return vane operator to closed position on fan shutdown.

2.07 WALL-, SURFACE-, AND DUCT-MOUNT SENSORS

A. Temperature Sensors:
   1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
   2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
   3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
   4. Temperature Sensing Device: Compatible with project DDC controllers.
   5. Performance Characteristics:
      a. RTD:
         1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
         2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
         3) Chilled Water Accuracy: Plus/minus 0.50 degrees F minimum.
         4) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
         5) Range: Minus 40 degrees F through 220 degrees F minimum.
      b. Thermistor:
         1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
         2) Range: Minus 25 degrees F through 122 degrees F minimum.
         3) Heat Dissipation Constant: 2.7 mW per degree C.
      c. Sensing Range:
         1) Provide limited range sensors if required to sense the range expected for a respective point.
         2) Use RTD type sensors for extended ranges beyond minus 30 to 230 degrees F.
         3) Use temperature transmitters in conjunction with RTDs when RTDs are incompatible with DDC controller direct temperature input.
      d. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
      e. Immersion Temperature Sensors: A sensor encased in a corrosion-resistant probe with an indoor junction box service entry body.
      f. Room Temperature Sensors with Integral Digital Display:
         1) Provide a four button keypad with the following capabilities:
            (a) Indication of space and outdoor temperatures.
            (b) Setpoint adjustment to accommodate room setpoint, DDC Input/Output Points List, and Sequence of Operation.
            (c) Display and control fan operation status.
            (d) Manual occupancy override and indication of occupancy status.
            (e) Controller mode status.
            (f) Password enabled setpoint and override modes.
      g. Temperature Averaging Elements:
         1) Use on duct sensors for ductwork 10 sq ft or larger.
         2) Use averaging elements where prone to stratification with sensor length 8 ft or 16 ft.
         3) Provide for all mixed air and heating coil discharge sensors regardless of duct size.
      h. Insertion Elements:
         1) Use in ducts not affected by temperature stratification or smaller than 11 sq inches.
         2) Provide dry type, insertion elements for liquids, installed in immersion wells, with minimum insertion length of 2.5 inches.

B. Humidity Sensors, Duct-Mounted:

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1. Replaceable digitally profiled thin-film capacitive sensor probe extended from die-cast metal, weather-proof plastic or metal housing designed for duct mounting.
2. Measuring Scale: 0 to 100 percent RH, noncondensing, temperature compensated.
3. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
4. Accuracy: Plus/minus 1 percent between 20 to 40 percent RH linear range, NIST traceable with multi-point calibration.

C. Humidity Transmitters, Surface-Mounted:
1. Plastic housing encased, wall-mounted, humidity indicatingsensor.
2. Humidity Sensor Type: Replaceable thin-film capacitive.
3. Accuracy: 1 percent at rated measuring scale and capable of withstanding 95 percent relative humidity without loss of calibration.
4. Output: Two-wire, 4 to 20 mA, 0 to 5 VDC or 0 to 10 VDC, non-loop powered, selectable.

D. IAQ (Indoor Air Quality) Sensors:
1. Form Factor: Surface mounted, desk mounted, or single-gang electrical-box-mounted module made of high-impact plastic or other resilient material.
2. CO2 (Carbon Dioxide) Monitoring Sensor:
   a. Non-dispersive infrared (NDIR) type, 0 to 100 %RH range.
   b. Accuracy: Plus/minus 30 ppm within three percent of measured value.
3. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.

E. Building Static Pressure Transmitters:
1. Single port for direct or tubing connection into wall or ceiling static pressure tip, direct acting, double bell, scale range 0.01 to 6.0 in-wc positive or negative, and sensitivity of 0.0005 in-wc. Transmit electronic signal to receiver with matching scale range.

F. Static-Air Pressure Sensors:
1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
3. Accuracy: One percent of full scale with repeatability 0.3 percent.
4. Output: 0 to 5 vdc with power at 12 to 28 vdc.

G. Air Pressure Transmitters:
1. General: Provide dry air media, differential pressure transducers to monitor duct pressure.
2. Accuracy: Plus/minus 2 percent full scale of range with combined linearity and hysteresis.
3. Zero Adjust: Pushbutton auto-zero and digital input using 2-position terminal block.
4. Measuring Range: 1 to 10 in-wc, unidirectional or bidirectional.
5. Hardwired Output: 2-wire, loop-powered 4 to 20 mA, field selectable.
6. Proof and Burst Pressure (pressure differential): 3 and 5 psid.

H. Damper Position Indicators: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 to 100 percent damper travel.

I. Carbon Monoxide Sensors:
1. Gas sensing module that holds fixed or replaceable carbon monoxide gas-sensor cartridge.
2. Form Factor: IEC 60529, IP20 enclosure, single-gang electrical box mounted.
3. Electromechanical sensor with 0 to 500 ppm measurement range.
4. Accuracy: Plus/minus Five percent of range with 1 ppm resolution.
5. Hardwired Output: Three-wire, 4 to 20 mA, loop powered.
6. Alarm: Auxiliary dry contact relay driven by setpoint adjustable between 25 to 180 ppm.

J. Carbon Dioxide Sensors, Duct and Wall:
1. General: Provide nondispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
2. Air Temperature: Range of 32 to 122 degrees F.

3. Relative Humidity: Range of 0 to 95 percent (noncondensing).
4. Calibration Characteristics:
   a. Automatically compensating algorithm for sensor drift due to sensor degradation.
   b. Maximum Drift: 2 percent.
   c. User calibratable with a minimum calibration interval of 5 years.
5. Construction:
   a. Sensor Chamber: Noncorrosive material for neutral effect on carbon dioxide sample.
   b. Provide duct mounted sensors with duct probe designed to protect sensing element from dust accumulation and mechanical damage.
   c. Housing: High impact plastic.

2.08 THERMOSTATS

A. Low-Limit Temperature Cutout Switch:
   1. Configuration: Vapor-filled capillary.
   2. Probe Sensing Length: 20 feet.
   3. Setpoint Adjust Control: Screw, concealed with manual reset switch.
   4. Switch Type: SPDT, snap-action, form C in dust-protected enclosure.
   5. Sensing Range: 15 to 55 degrees F.
   6. Mounting: Locate on cooling coil intake side.
   7. Field Interface: Connect load line-voltage to starter.

2.09 TIME SWITCHES

A. Digital Electronic Time Switches:
   1. Description: Factory-assembled, solid-state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability:
      a. Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
   3. Schedule Capacity: Not less than 16 programmable on/off operations.
   4. Provide automatic daylight savings time and leap year compensation.
   5. Provide power outage backup to retain programming and maintain clock.
   6. Manual Override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
   7. Input Supply Voltage: 120 VAC unless otherwise indicated.
   8. Provide lockable enclosure; environmental type complying with NEMA EN 10250 as specified for the following installation locations:

2.10 FAN AND PUMP MOTOR RUN-STATUS MONITORING

A. Current Switches:
   1. Mini Solid-Core: 2-State, On/Off digital output of motor status with adjustable trip point to detect belt loss or mechanical failure.
   2. Mini Split-Core: 2-state, On/Off digital output of inverter-duty motor status with adjustable trip point to detect belt loss or mechanical failure.
   3. Solid Core: 2-state, On/Off digital output of motor status with adjustable trip point to detect belt loss or mechanical failure and built-in pilot duty relay.
   4. Split Core: 2-state, On/Off digital output of inverter-duty motor status with adjustable trip point to detect belt loss or mechanical failure and built-in pilot duty relay.
   5. Maximum AC Current Monitoring Value: As indicated on drawings.

B. Differential Pressure Switches:
   1. Fan Status: Select for adjustable range between 0 to 5 in-wc across fan discharge and external or fan inlet. Include static pressure tips.

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2. Pump Status: Select for adjustable range between 8 to 60 psi across pump discharge and suction sides. Include static pressure tips and 3-way valve manifold.

2.11 PIPE-MOUNTED SENSORS AND TRANSMITTERS

A. Temperature Sensors:
1. Pipe-mounted temperature probe tied to weather-resistant enclosure for direct insertion into compatible liquids or gases or inserted into intermediary thermal grease-filled pipe-well compatible with interfaced fluid.
2. Sensor Type: 1,000 ohm Platinum RTD.
3. Transmitter: Fitted within probe-interface enclosure, calibrated.
   a. Monitoring Range: 32 to 122 degrees F, adjustable.
   b. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
   c. Accuracy: Plus/minus three percent. adjustable on the transmitter end.
4. Accessories: Provide downstream PT test plug and brass pipe-well.

B. Differential Pressure Transmitters:
1. General: Provide wet media differential pressure transducers with 6 ft (1.83 m) armored cable, to allow local or remote pressure sensing capability using existing plumbing runs.
   a. Input Power: Class 2; 15 to 30 VDC, 24VAC nominal, 50/60 Hz.
   b. Output: 3-wire transmitter; 4 to 20 mA, 0 to 5V, or 0 to 10V, selectable,
   c. Sensor:
      1) Media Compatibility: 17 to 4 PH stainless steel.
      2) Status Indication: Dual color LED.
      3) Proof Pressure: 2x max. F.S. range.
      4) Burst Pressure: 5x max. F.S. range.
      5) Accuracy at 77 degrees F for less than or equal 20 ft:
         (a) Ranges A and B: Plus/minus 1 percent F.S. typical.
         (b) Range C: Plus/minus 1.5 percent F.S. typical.
         (c) Range D: Plus/minus 2 percent F.S. typical.
      6) Surge Damping: Electronic; 1 second averaging.
      7) Long Term Stability: Plus/minus 0.25 percent.
   d. Pressure Ranges:
      1) 0 psi to 50 psi (Gauge): 5 psid/10 psid/25 psid/50 psid (pressure differential).
      2) 0 psi to 100 psi (Gauge): 10 psid/20 psid/50 psid/100 psid (pressure differential).
      3) 0 psi to 250 psi (Gauge): 25 psid/50 psid/125 psid/250 psid (pressure differential).
   e. Enclosure: NEMA EN 10250, Type 4.

C. Flow Switches:
1. Repetitive Accuracy: Plus/minus 10 percent of actual flow setting.
2. Switch Actuation: Adjustable over the operating range and sized for the application, such that the setpoint is between 25 and 75 percent of the full range.
3. Provide Form C snap-action contacts, rated for the application.
4. Furnish nonflexible paddle with magnetically actuated contacts, rated for service at a pressure greater than the installed conditions.

D. Turbine Flow Meters:
1. Insertion Type: Provide for 4 inch pipe with ball valve and threadolet.
2. Flow Capacity Range: As indicated on drawings.
3. Coated ductile iron case, polymer-based cap, test port, and hermetically sealed register with low flow indicator.
4. Pressure and Temperature: Up to 175 psi and 120 degrees F.
5. Accessories: Provide downstream PT test plug and sight flow indicator.

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2.12 ENERGY METERING

A. Hydronic Energy Meters:
   1. LCD-indicating Btu/h energy meter with wall-mounted hardware capable of being installed remotely for direct connection into field-mounted compatible flow meter and temperature sensors or probes for supply and return sides.
   2. Factory configured to dynamically monitor, calculate, and output energy demand based on user configured field setting via the front panel keypad or computer interface.
   3. Integral transmitter to provide a linear analog or configurable pulse output signal representing the energy rate.
   4. Software Outputs: Energy demand, energy consumption, flow rate, supply temperature, return temperature, and temperature difference.
   5. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 48 inches above floor. Align with lighting switches and humidistats; see Section 26 2726.

C. Mount freeze protection thermostats using flanges and element holders.

D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

E. Provide separable sockets for liquids and flanges for air bulb elements.

F. Provide thermostats in aspirating boxes in front entrances, gymnasiums, high security areas, and where indicated.

G. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

H. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors.

I. Provide isolation (two-position) dampers of parallel blade construction.

J. Mount control panels adjacent to associated equipment on vibration free walls or free-standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

K. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION

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SECTION 23 0923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. Power supplies and line filtering.

E. Controller software.

F. HVAC control programs.

1.02 RELATED REQUIREMENTS

A. Section 23 0913 - Instrumentation and Control Devices for HVAC.

B. Section 23 0993 - Sequence of Operations for HVAC Controls.

C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata (2023).

B. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:
   1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
   2. List connected data points, including connected control unit and input device.
   3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.
   4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
   5. Indicate description and sequence of operation of operating, user, and application software.

D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Include submittals data in final "Record Documents" form.

E. Operation and Maintenance Data:
   1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
   3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

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1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Substantial Completion.

C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

PART 2 PRODUCTS

2.01 BIDDING

A. Owner will select one alternate from Alternates 3A-3C to be included with Base Proposal. Do not include automation controls in the Base Bid Proposal. Refer to 01 2300 - Alternates for more information.

2.02 MANUFACTURERS

A. Carrier i-Vu.

2.03 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units with communications to Building Management System specified in Section 23 09 23.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.04 OPERATOR INTERFACE

A. PC Based Work Station:
   1. Resides on high speed network with building controllers.
   2. Connected to server for full access to all system information.

B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

C. BACnet protocol to comply with ASHRAE Std 135.

2.05 CONTROLLERS

A. Building Controllers:
   1. General:
      a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.

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b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
c. Share data between networked controllers.
d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
e. Utilize real-time clock for scheduling.
f. Continuously check processor status and memory circuits for abnormal operation.
g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
h. Communication with other network devices to be based on assigned protocol.

2. Communication:
a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
b. Perform routing when connected to a network of custom application and application specific controllers.
c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:
a. Outdoors and/or in Wet Ambient Conditions:
1) Mount within waterproof enclosures.
b. Conditioned Space:
1) Mount within dustproof enclosures.

4. Provisions for Serviceability:
a. Diagnostic LEDs for power, communication, and processor.
b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

6. Power and Noise Immunity:
a. Maintain operation at 90 to 110 percent of nominal voltage rating.
b. Perform orderly shutdown below 80 percent of nominal voltage.
c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Custom Application Controller:
1. General:
a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
b. Share data between networked, microprocessor based controllers.
c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
d. Utilize real-time clock for scheduling.
e. Continuously check processor status and memory circuits for abnormal operation.
f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
g. Communication with other network devices to be based on assigned protocol.

2. Communication:
a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:

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a. Outdoors and/or in Wet Ambient Conditions:
1) Mount within waterproof enclosures.
b. Conditioned Space:
1) Mount within dustproof enclosures.

4. Provisions for Serviceability:
a. Diagnostic LED's for power, communication, and processor.
b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
a. Maintain operation at 90 to 110 percent of nominal voltage rating.
b. Perform orderly shutdown below 80 percent of nominal voltage.
c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

C. Application Specific Controllers:
1. General:
a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
b. Customized for operation within the confines of equipment served.
c. Communication with other network devices to be based on assigned protocol.
2. Communication:
a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
a. Outdoors and/or in Wet Ambient Conditions:
1) Mount within waterproof enclosures.
b. Conditioned Space:
1) Mount within dustproof enclosures.
4. Provisions for Serviceability:
a. Diagnostic LEDs for power, communication, and processor.
b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
a. Maintain operation at 90 to 110 percent of nominal voltage rating.
b. Perform orderly shutdown below 80 percent of nominal voltage.
c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

D. Input/Output Interface:
1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:

a. Allow monitoring of On/Off signals from remote devices.
b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
c. Sense dry contact closure with power provided only by the controller.

4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
   b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Outputs provided with three position (On/Off/Auto) override switches.
   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
   c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
   b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
      1) VAV terminal units.
   c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
   a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
   b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.06 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.
8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

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B. Power Line Filtering:
   1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
   2. Minimum surge protection attributes:
      a. Dielectric strength of 1000 volts minimum.
      b. Response time of 10 nanoseconds or less.
      c. Transverse mode noise attenuation of 65 dB or greater.
      d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.07 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
   1. User access secured via user passwords and user names.
   2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts are recorded.
   4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
   1. Weekly Schedules Based on Separate, Daily Schedules:
      a. Include start, stop, optimal stop, and night economizer.
      b. 10 events maximum per schedule.
      c. Start/stop times adjustable for each group object.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
   1. Binary object is set to alarm based on the operator specified state.
   2. Analog object to have high/low alarm limits.
   3. All alarming is capable of being automatically and manually disabled.
   4. Alarm Reporting:
      a. Operator determines action to be taken for alarm event.
      b. Alarms to be routed to appropriate workstation.
      c. Reporting Options:

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software based upon specified sequences of operation in Section 23 0993.

H. PID Control Characteristics:
   1. Direct or reverse action.
   2. Anti-windup.
   3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
   4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:
   1. Prevents all controlled equipment from simultaneously restarting after power outage.
   2. Order of equipment startup is user selectable.

J. Energy Calculations:
   1. Accumulated instantaneous power or flow rates are converted to energy use data.
   2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.

3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

K. Anti-Short Cycling:
1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

L. On-Off Control with Differential:
1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

M. Run-Time Totalization:
1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

2.08 HVAC CONTROL PROGRAMS

A. General:
1. Support Inch-pounds and SI (metric) units of measurement.
2. Identify each HVAC Control system.

B. Optimal Run Time:
1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.
5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.

C. Supply Air Reset:
1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.
2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
   a. Raising cooling temperatures to highest possible value.
   b. Reducing heating temperatures to lowest possible level.

D. Enthalpy Switchover:
1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.

2.09 CHILLER CONTROL PROGRAMS

A. Control function of condenser water reset, chilled water reset, and chiller sequencing. Support inch-pounds and SI (metric) units of measurement.

B. Condenser Water Reset: Automatically reset controlled condenser water temperature using measured outside wet bulb temperature and load being handled.

C. Chilled Water Reset: Automatically reset controlled chilled water temperature satisfying cooling coil requiring greatest cooling.

D. Chiller Sequencing: Determine which combination of chillers will most efficiently satisfy chilled water load, by cycling chillers, based on comparing load to switchover limits defined for each chiller.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.

C. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

END OF SECTION

SECTION 23 0934
VARIABLE-FREQUENCY MOTOR CONTROLLERS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

1.02 RELATED REQUIREMENTS

A. Section 23 0529 - Hangers and Supports for HVAC Piping and Equipment.

B. Section 23 0553 - Identification for HVAC Piping and Equipment: Identification products and requirements.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0573 - Power System Studies: Additional criteria for selection and adjustment of equipment and associated protective devices specified in this section.

E. Section 28 4600 - Fire Detection and Alarm: For interface with variable-frequency motor controllers.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.

D. NEMA IS 10033 - Industrial Control and Systems: Adjustable-Speed Drives; 2026.

E. NEMA IS 10034 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems; 2022 (Reapproved 2025).

F. NEMA IS 10035 - Application Guide for AC Adjustable Speed Drive Systems; 2021 (Reaffirmed 2025).

G. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems; 2005.

H. NEMA MG 00001 - Motors and Generators; 2024.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy (Ed. 2); Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work to provide motor controllers suitable for use with actual motors to be installed.
   2. Coordinate work to provide controllers and associated wiring suitable for interface with control devices to be installed.
   3. Coordinate arrangement with dimensions and clearance requirements of actual equipment to be installed.
   4. Verify with manufacturer that conductor terminations are suitable for use with conductors to be installed.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

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1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
   1. Authorized service facilities located within 200 miles of project site.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Controller Assemblies: Comply with NEMA IS 10033, NEMA IS 10034, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

D. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA IS 10035, NEMA MG 00001 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:
   1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 00001 design letter or inverter duty rating for induction motors.
   2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
   3. Motor nameplate data.
   4. Requirements for speed control range, speed regulation, and braking.
   5. Motor suitability for bypass starting method, where applicable.

E. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

F. Operating Requirements:
   1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
   2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
   3. Efficiency: Minimum of 96 percent at full speed and load.
   4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
   5. Overload Rating:

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a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

G. Power Conversion System: Microprocessor-based, pulse width modulation type consisting of rectifier/converter, DC bus/link, and inverter.
1. Rectifier/Converter: Diode-based, 6-pulse type unless otherwise indicated.

H. Control System:
1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
3. Control Functions:
a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
2) Vector Control: Provide selectable autotuning function.
b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
c. Selectable braking control; DC injection or flux braking.
d. Adjustable minimum/maximum speed limits.
e. Adjustable pulse width modulation switching carrier frequency.
f. Adjustable motor slip compensation.
g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
h. Safety Interlock: Provide permissive run safety interlock capability where indicated or required; upon activation of designated input, stop and prevent operation of motor; operational in both drive and bypass modes where applicable.
i. Damper/Valve Control: Provide damper/valve control capability where indicated or required; upon receiving motor start command, activate designated damper/valve output and delay motor start until activation of designated end switch input confirms damper/valve operation.
4. Status Indications:
a. Motor run/stop status.
b. Motor forward/reverse status.
c. Local/remote control status.
d. Output voltage.
e. Output current.
f. Output frequency.
g. DC bus voltage.
h. Motor speed.
5. Protective Functions/Alarm Indications:
a. Overcurrent.
b. Motor overload.
c. Undervoltage.
d. Overvoltage.
e. Controller overtemperature.
f. Input/output phase loss.
g. Output short circuit protection.
h. Output ground fault protection.
6. Inputs:

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a. Digital Input(s): Six.
b. Analog Input(s): Two.

7. Outputs:
   a. Analog Output(s): Two.
   b. Relay Output(s): Three.
8. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.
   a. Serial Communications: RS-485; support for BACnet MS/TP protocol.
   b. Remote Monitoring Capabilities:
      1) Motor run/stop status.
      2) Hand-off-auto status.
      3) Fault information.
      4) Discrete input/output status.
      5) Analog input/output values.
   c. Remote Control Capabilities:
      1) Motor run/stop command.
      2) Hand-off-auto selection.
      3) Speed adjustment.
      4) Fault reset.
9. Features:
   a. Password-protected security access.
   b. Event log.

I. Power Conditioning/Filtering:
   1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.
   2. Reactor Impedance: 3 percent, unless otherwise indicated or required.

J. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
   1. Disconnects: Circuit breaker or disconnect switch type.
      a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
      b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
      c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
   2. Provide door-mounted remote operator interface.

K. Service Conditions:
   1. Provide controllers and associated components suitable for operation under following service conditions without derating:
      a. Altitude: Less than 3,300 feet.
      b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
   2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.

L. Short Circuit Current Rating:
   1. Provide controllers with listed short circuit current rating not less than available fault current at installed location as determined by short circuit study performed in accordance with Section 26 0573.
   2. Provide line/input reactors where specified by manufacturer for required short circuit current rating.

M. Conductor Terminations: Suitable for use with conductors to be installed.

N. Enclosures:

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1. Comply with NEMA IA 10030.
2. NEMA EN 10250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 12.
   b. Outdoor Locations: Type 3R or Type 4.
3. Finish: Manufacturer's standard unless otherwise indicated.
4. Cooling: Forced air or natural convection as determined by manufacturer.

O. Interface with Other Work:
1. Provide products compatible with other systems requiring interface with controllers.
2. Interface with building automation system as specified in Section 23 09 23.
   a. Capable of remote monitoring and control of controllers.
3. Interface with fire alarm control system as specified in Section 28 4600.
   a. Capable of affecting operation of selected HVAC equipment for selected fire alarm system events.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of controllers are consistent with indicated requirements.

C. Verify that mounting surfaces are ready to accept controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install in accordance with NEMA IS 10034 and manufacturer's instructions.

C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 23 0529.

F. Install controllers plumb and level.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Install field-installed devices, components, and accessories.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

K. Identify controllers in accordance with Section 23 0553.

3.03 PROTECTION

A. Protect installed controllers from subsequent construction operations.

END OF SECTION

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SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Valves.
E. Strainers.
F. Check valves.
G. Pressure regulators.
H. Pressure relief valves.
I. Filter-driers.
J. Solenoid valves.
K. Expansion valves.
L. Receivers.
M. Engineered wall seals and insulation protection.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.
B. Section 23 0716 - HVAC Equipment Insulation.

1.03 REFERENCE STANDARDS

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers; 2005.
B. AHRI 760 (I-P) - Performance Rating of Solenoid Valves for Use with Volatile Refrigerants; 2014.
C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Errata (2023).
D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.
F. ASME B31.9 - Building Services Piping; 2020.
G. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
H. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.
I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
J. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).
K. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

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M. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

N. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

O. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

P. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

Q. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

R. UL 429 - Electrically Operated Valves; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturer's catalog data including load capacity.

C. Submit welders certification of compliance with ASME BPVC-IX.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure integrity of system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

C. Liquid Indicators:
1. Use line size liquid indicators in main liquid line leaving condenser.
2. If receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

D. Valves:
1. Use service valves on suction and discharge of compressors.
2. Use gauge taps at compressor inlet and outlet.
3. Use gauge taps at hot gas bypass regulators, inlet and outlet.
4. Use check valves on compressor discharge.
5. Use check valves on condenser liquid lines on multiple condenser systems.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:
1. Use line size strainer upstream of each automatic valve.
2. Use shut-off valve on each side of strainer.

G. Filter-Driers:
1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

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H. Receivers:
1. Use on systems with long piping runs.

2.02 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.

2.03 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
1. Provide hangers and supports that comply with MSS SP-58.
a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Vertical Support: Steel riser clamp.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.05 VALVES

A. Diaphragm Packless Valves:
1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, soldered or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

B. Packed Angle Valves:
1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, soldered or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Ball Valves:
1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

D. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

2.06 STRAINERS

A. Straight Line or Angle Line Type:

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1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.07 CHECK VALVES

A. Globe Type:
   1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

2.08 PRESSURE REGULATORS

A. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi range, for maximum working pressure of 450 psi.

2.09 PRESSURE RELIEF VALVES

A. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi.

2.10 FILTER-DRIERS

A. Performance:
   1. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
   2. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.

2.11 SOLENOID VALVES

A. Valve: AHRI 760 (I-P), pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, soldered, or threaded ends; for maximum working pressure of 500 psi.

B. Coil Assembly: UL 429 UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

2.12 ELECTRONIC EXPANSION VALVES

A. Valve:
   1. Brass body with flared or soldered connection, needle valve with floating needle and machined seat, stepper motor drive.

B. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.13 RECEIVERS

A. Internal Diameter 6 inch and Smaller:
   1. AHRI 495, UL listed, steel, brazed; 400 psi maximum pressure rating, with tappings for inlet, outlet, and pressure relief valve.

2.14 ENGINEERED WALL SEALS AND INSULATION PROTECTION

A. Basis of Design: Airex Manufacturing, Inc; www.airexmfg.com/#sle.
   1. Pipe Penetration Wall Seal: Airex Titan Outlet.
   2. Refrigeration Pipe Insulation Protection System: Airex E-Flex Guard.

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B. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
   1. Outlet Cover Color: As selected by Architect.
   2. Water Penetration: Comply with ASTM E331.
   3. Air Leakage: Comply with ASTM E283/E283M.
   4. Air Permeance: Comply with ASTM E2178.

C. Insulation Protection System: Mechanical line insulation and PVC cover.
   1. PVC Insulation Cover Color: Black with full-length velcro fastener.
   2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
   3. Water/Vapor Permeability: Comply with ASTM E96/E96M.
   4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.
   5. Flame Spread and Smoke Development Rating of 25/450: Comply with ASTM E84.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain-end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as indicated.
   3. Place hangers within 12 inches of each horizontal elbow.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. Provide copper plated hangers and supports for copper piping.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.

J. Flood piping system with nitrogen when brazing.

K. Insulate piping.

L. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

M. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

N. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

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O. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

P. Fully charge completed system with refrigerant after testing.

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.
B. Flexible ducts.
C. Nonmetal ducts.
D. Air plenums and casings.
E. Ducts for kitchen exhaust applications.
F. Ducts for laboratory and industrial-grade applications.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 09 9113 - Exterior Painting: Weld priming, weather resistant, paint or coating.
C. Section 09 9123 - Interior Painting: Weld priming, paint or coating.
D. Section 11 4000 - Foodservice Equipment: Kitchen range hoods.
E. Section 23 0713 - Duct Insulation: External insulation and duct liner.
F. Section 23 3300 - Air Duct Accessories.
G. Section 23 3319 - Duct Silencers.
H. Section 23 3600 - Air Terminal Units.
I. Section 23 3700 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ANSI Z9.5 - Laboratory Ventilation; 2022.
B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
C. ASHRAE Std 126 - Method of Testing HVAC Air Ducts; 2020.
D. ASME AG-1 - Code on Nuclear Air and Gas Treatment; 2023.
E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
G. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals; 2019.
H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.
J. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids; 2020.
K. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
M. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.
N. SMACNA (PVC) - Thermoplastic Duct (PVC) Construction Manual; 1995.

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O. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

P. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

Q. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Shop drawings to be provided prior to start of work for all duct systems. Provide drawings in 1/4" per foot scale or larger.
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating sizes, configurations, liner material, and static-pressure classes.
3. Elevation of top and bottom of ducts.
4. Fittings
5. Reinforcement and spacing.
6. Seam and joint construction.
7. Penetrations through fire-rated and other partitions.
8. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A, NFPA 90B, and SMACNA (DCS) guidelines unless stated otherwise.

B. Perform Work in accordance with SMACNA (DCS).

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 3319.

D. Structural Performance: Duct hangers and supports are to withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA (DCS) and ASCE 7.

E. Wind Performance: Ducts are to withstand the effects of wind and tornado loads determined in accordance with ASCE 7.

F. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.

G. Duct Shape: Provide round/rectangular duct as indicated on plan.

H. Duct Wall Type: Single wall ductwork is allowed in all concealed applications. For ductwork exposed to view, provide double-wall insulated ductwork.

I. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness. Contractor may alter duct dimensions, provided an equivalent net clear free area is maintained. For rectangular duct, aspect ratio shall be maintain less than 4:1.

J. Duct Materials:
1. Construct ducts or galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

K. Duct Fabrication Requirements:
1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.
8. All round ductwork, exposed to view, shall be constructed of sprial seam pipe.

2.02 METAL DUCTS

A. Rectangular Metal Duct:
1. Rectangular Double Wall Insulated: Rectangular spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.
a. Insulation:
1) Thickness: 1 1/2 inch.
2) Material: Fiberglass.
b. Where noted on plans, provide outer surface with paint grip finish. Coordinate paint color with Architect.

B. Round Metal Ducts:
1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.
2. Round Double Wall Insulated Duct: Round spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.
a. Insulation:
1) Thickness: 1 1/2 inch.
2) Material: Fiberglass.
b. Where noted on plans, provide outer surface with paint grip finish. Coordinate paint color with Architect.
3. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

C. Round Spiral Duct:
1. Round spiral lock seam duct with galvanized steel outer wall.

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D. Connectors, Fittings, Sealants, and Miscellaneous:
   1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
   2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
   3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
      b. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
      c. For Use with Flexible Ducts: UL labeled.
   4. Gasket Tape:
      a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
   5. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 FLEXIBLE DUCTS

A. Flexible Ducts: UL 181, Class 1, polyethylene film, mechanically fastened and rolled using galvanized steel to form spiral helix.
   1. Insulation: R6 insulation with aluminized vapor barrier film.
   2. Pressure Rating: 10 in-wc positive and 5 in-wc negative.
   3. Maximum Velocity: 4000 fpm.
   4. Temperature Range: Minus 20 degrees F to 250 degrees F.

2.04 NON-METAL DUCTS

A. Manufacturers:
   1. DuctSox Corporation
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Internal Hoop System: Air diffusers shall be constructed with internal retention system consisting of internal 360 degree hoop system, spaced minimum 5' on center installed with a one row suspension system located 1.5" above top-dead-center of the textile system. System shall have hot dipped galvanized or stainless steel construction.

C. External Support:
   1. System attachment to external tension cable.
   2. Cable suspension hardware to include stainless steel cable, eye bolts, thimbles, cable clamps, and turnbuckle(s) as required.

D. Textile Construction: Filament/filament Twill polyester, treated with a machine washable anti-microbial agent by the fabric manufacturer, fire retardant in accordance with UL 2518. Non-linting filament yarn to meet the requirements of ISO Class 3 Environment.
   1. Air Permeability: 2 (+2/-1) CFM/ft² per ASTM D737.
   2. Weight: 6.8 oz./yd² per ASTM D3776.
   3. Warranty: Fifteen (15) years.
   4. Color: Per Architect

E. Textile system to be constructed in modular lenths (zippered) with proper radial securing clips (inlets, endcaps and mid-sections) and top access zippers for vertical cable safety attachment.

F. Integrated air dispersion shall be selected by manufacturer based on best air distribution performance for both cooling and heating modes of operation for specified space of duct installation for variable air volume in cooling and constant air volume in heating.
   1. Linear Vents: Integrated air dispersion shall be specified and approved by manufacturer.

a. Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on 0.5" SP), starting at 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
b. Size of vent openings and location of linear vents to be specified and approved by manufacturer.

2. Orifices - 2" and 3" Sewn in Grommets:
   a. Air dispersion and extended throws are accomplished by reinforced orifices and permeable fabric. Reinforced orifices are to be installed to keep the integrity of opening and withstand laundry processes.
   b. Diameter, quantity, and location of reinforced orifices to be specified and approved by the manufacturer.
3. Fixed Nozzles:
   a. Air dispersion accomplished by using conical aerodynamic nozzles and permeable fabric. Diameter of nozzles height to be minimum 1/2". Due to exact requirements of throw and maximum level of noise alternative flow models are not acceptable.
   b. Color of nozzles must match color of fabric.
   c. Location and number of nozzles to be specified and approved by the manufacturer.

G. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via zip screw fastener - supplied by contractor. Inlet connection shall include zipper for easy removal/maintenance.

H. System to include adjustable flow devices to balance turbulence, airflow and distribution as required.

I. Install system in strict accordance with manufacturer's installation instructions.

2.05 AIR PLENUMS AND CASINGS

A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.

B. Minimum Fabrication Requirements:
1. Fabricate acoustic plenum or casing with reinforcing turned inward.
2. Provide 16-gauge, 0.059-inch sheet steel back facing and 22-gauge, 0.029-inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers.
3. Construct panels 3 inches thick, packed with 4.5 pcf minimum glass fiber insulation media, on inverted channel of 16-gauge, 0.059-inch sheet steel.
4. Mount floor-mounted plenum or casings on 4-inch high concrete curbs. At floor, rivet panels on 8-inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18-gauge, 0.052-inch expanded metal mesh supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.

C. Access Doors:
1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.
3. Provide clear wire glass observation ports, minimum 6 by 6 inch size.

2.06 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

A. Provide ductwork, fittings, and appurtenances in accordance with NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.

B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.

C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.

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D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.

E. Dishwasher Exhaust Duct:
   1. Duct Size: 2 in-wc pressure class stainless steel.
   2. Fabricate using single wall, 18-gauge, 0.050-inch Type 304 stainless steel with external welded joints.
   3. Seal joints during installation with factory-supplied overlapping V-bands and sealant.

2.07 DUCTS FOR LABORATORY AND INDUSTRIAL-GRADE APPLICATIONS

A. Sectional Shape and Material Requirements:
   1. Round Thermoplastic (PVC I) Duct:
      a. Class 5 Air Duct Capacity:
         1) Pressure Class: Minus 10 in-wc.
         2) Maximum Temperature: 100 degrees F.
      b. Protection: Apply ultraviolet protection for segments exposed to direct sunlight.
      c. Compliance: Provide reinforced ductwork, fittings, supports, hangers, and appurtenances in compliance with SMACNA (PVC).

B. Laboratory Exhaust Applications:
   1. Dust Collector Exhaust: Round thermoplastic (PVC) ductwork.
   2. Fume Hood Cabinet Exhaust:
      a. Minimum 20-gauge, 0.035-inch Type 304 stainless steel, unless noted otherwise.
         1) Fabricate in accordance with ductwork manufacturer's instructions; test duct system to sustain positive and negative pressures in accordance with ASHRAE Std 126 and ASME AG-1.
      b. Provide ductwork and appurtenances in accordance with NFPA 91 requirements except where NFPA 45 applications take precedence.
      c. Coordinate duct, fittings, hangers, and accessories to comply with ANSI Z9.5.
      d. Design, fabricate, and install liquidtight preventing exhaust leakage into the building.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Comply with safety standards NFPA 90A and NFPA 90B.

C. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Flexible Ducts: Connect to metal ducts with draw bands.

F. Kitchen Range Hoods: Install when provided by Section 11 4000 then fit-out with respective ductwork and accessories to interconnect exhaust system.

G. Kitchen Hood Exhaust: Provide residue traps at the base of vertical risers with provisions for the cleanout.

H. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

I. Provide openings in ductwork as indicated to accommodate thermometers and controllers. Provide pilot tube openings as indicated for testing of systems, complete with metal can with spring device or screw to insure against air leakage. For openings, insulate ductwork and install insulation material inside a metal ring.

J. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

K. Use double nuts and lock washers on threaded rod supports.

L. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

M. Connect diffusers or light troffer boots to low-pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

N. Set plenum doors at 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

O. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

P. Louver Fit-out:
   1. Provide blank-out panels sealing available area of wall-mounted exterior-faced louver when connected ductwork is smaller than actual louver free area, and duct outlet is smaller than the louver frame.
   2. Use the same duct material painted black on the exterior side, then seal louver frame and duct.

Q. Fire Partitions: Provide firestopping sealing. See Section 07 8400.

R. Duct Accessories, Terminal Units, Inlets, and Outlets: Interconnect as indicated in Sections 23 3300, 23 3600, and 23 3700.

S. Duct Insulation: Provide duct insulation. See Section 23 0713.

T. Painting: Provide surface finish as indicated on drawings. See Sections 09 9113 and 09 9123.

END OF SECTION

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SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backdraft dampers - metal.
B. Combination fire and smoke dampers.
C. Duct access doors.
D. Duct test holes.
E. Fire dampers.
F. Flexible duct connectors.
G. Smoke dampers.
H. Smoke and fire-smoke damper test module.
I. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.
C. NFPA 92 - Standard for Smoke Control Systems; 2021, with Amendment.
D. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.
E. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.
F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.
G. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
H. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.
I. UL 555C - Standard for Safety Ceiling Dampers; Current Edition, Including All Revisions.
J. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide for shop-fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
C. 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 Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

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PART 2 PRODUCTS

2.01 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet metal; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
   1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.02 BACKDRAFT DAMPERS - METAL

A. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

B. Provide factory sleeve and collar for each damper.

C. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

D. Operators: UL listed and labeled; spring-return, electric-type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

E. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.

F. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.04 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Access doors with sheet metal screw fasteners are not acceptable.

2.05 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.06 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Ceiling (Radiation) Dampers: Galvanized steel, 22-gauge, 0.0299-inch frame and 16-gauge, 0.0598-inch flap, two layers of 0.125-inch thick ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
   1. Boot Fitting: Factory-provided el type (90 degree). Include field-provided collar.
   2. Rated for three hour service in compliance with UL 555C.

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C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1-inch pressure-class ducts up to 12 inches in height.

D. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.07 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
      a. Net Fabric Width: Approximately 2 inches wide.
   2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

C. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

D. Maximum Installed Length: 14 inch.

2.08 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.

C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.09 SMOKE AND FIRE-SMOKE DAMPER TEST MODULE

A. Addressable fire alarm system proprietary controller module preconfigured for remote testing of dedicated smoke damper or combination fire-smoke damper.

B. Provide module, accessories, and connectivity to meet NFPA 80 and NFPA 105 requirements.

2.10 VOLUME CONTROL DAMPERS

A. Splitter Dampers:
   1. Material: Same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

B. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gauge, 0.0239 inch, minimum.

C. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches. Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
   1. Blade: 18 gauge, 0.0478 inch, minimum.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

E. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

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PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 3100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96 Provide minimum 8 by 8 inch size access door for hand and shoulder access, or as indicated on drawings. Provide minimum 4 by 4 inch size access door for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire-rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

K. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

L. Use splitter dampers only where indicated.

M. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

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SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Cabinet exhaust fans.

C. Upblast roof exhausters.

1.02 RELATED REQUIREMENTS

A. Section 23 3300 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

G. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

I. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

J. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. 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 Fan Belts: One set for each individual fan.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Request Owner permission to use permanent ventilator(s) for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck Fan Corporation

B. Loren Cook Company

C. Twin City Fan & Blower

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2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: Comply with AMCA 204.

B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.

D. Fabrication: Comply with AMCA 99.

E. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

G. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

2.03 CABINET EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resiliently mounted motor, gravity backdraft damper in discharge.

B. Grille: Aluminum with baked white enamel finish.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

D. Performance Ratings: As indicated on drawings.

2.04 UPBLAST ROOF EXHAUSTERS

A. Direct Drive Fan:
   1. Fan Wheel:
      a. Type: Non-overloading, backward inclined centrifugal.
      b. Material: Aluminum, statically and dynamically balanced.
   2. Housing:
      a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.
      c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
      d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.
      e. Provide breather tube for fresh air motor cooling and wiring.

B. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

C. Drive Assembly:
   1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
   2. Belts: Static free and oil resistant.
   3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
   4. Motor pulley adjustable for final system balancing.
   5. Readily accessible for maintenance.

D. Disconnect Switches:
   1. Factory mounted and wired.

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2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
3. Finish for Painted Steel Enclosures: Provide manufacturer's standard or factory-applied gray unless otherwise indicated.
4. Positive electrical shutoff.
5. Wired from fan motor to junction box installed within motor compartment.

E. Roof Curb: 18 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, and factory installed nailer strip.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G. Options/Accessories:
1. Birdscreen:
   a. Provide aluminum construction.
   b. Protects fan discharge.
2. Dampers: Provide gravity type.
3. Finishes: Standard factory finish.
4. External motor speed controllers for field mounting.

H. Performance Ratings: As indicated on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Hung Cabinet Fans:
1. Install flexible connections between fan and ductwork; see Section 23 3300. Ensure metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

E. Provide sheaves required for final air balance.

F. Install backdraft dampers on inlet to roof and wall exhausters.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

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SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabric air distribution devices.

B. Gravity ventilators.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

B. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2022.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

H. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

J. UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 SUPPLY, RETURN, AND EXHAUST GRILLES, REGISTERS AND DIFFUSERS

A. Material: As scheduled on the contract drawings.

B. Finish: As selected by Architect

C. Face Size and Style: As scheduled on the contract drawings.

D. Mounting: As scheduled on the contract drawings. Ceiling mounted air devices shall be compatible with the type of ceiling in which they are to be installed. Contractor is responsible for coordinating with the architectural contract drawings to supply the proper air devices and adapting framework for the type of construction at each air device.

E. Accessories: As scheduled on the contract drawings.

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2.02 FABRIC AIR DISTRIBUTION DEVICES

A. General Requirements:
1. Diffuser material to comply with ASTM E84, UL 723, UL 2518, NFPA 90A, and NFPA 90B.
2. Air Dispersion Method:
   a. Laser Cut Perforations: 0.157-inch to 3-inch diameter laser cut holes. Location, number, and size determined by manufacturer. Mechanical hole punching methods are not acceptable.
3. Hanger Supports:
   a. Wire Suspension: Cable system includes cable, clamps, tie-down straps, and turnbuckles as required to support fabric ductwork. Mount cable and fabric duct connections in accordance with manufacturer's instructions.
   b. Reinforcing Devices:
      1) Internal arcs, ribs, or spines.
      2) Internal rings.
      3) Tensioning devices.

B. Continuous Diffusers:
1. Fabric: 100 percent flame retardant polyester treated with an antimicrobial agent from manufacturer.
2. Shape: Round.
3. Frame: Provide framing per manufacturer's recommendations.
4. Dimensions: As indicated on drawings.
5. Color: To be selected by Architect from manufacturer's standard range.
6. Damper: Provide volume control per manufacturer's recommendations.

2.03 GRAVITY VENTILATORS

A. Spun Aluminum Intake and Relief Gravity Ventilator:
1. General:
   a. Provide low silhouette configuration for intake and relief applications with natural gravity or negative pressure system.
   b. Performance ratings and factory testing in accordance with AMCA 511 and AMCA 550.
   c. Suitable for non-ducted applications.
   d. Equipment to bear permanently affixed manufacturer's nameplate listing model and serial number.
2. Hood:
   a. Material: Aluminum.
   b. Internal structure constructed of galvanized steel.
3. Birdscreen:
   a. Fabricate in accordance with ASTM B221 (ASTM B221M).
   b. Construction: 1/2 inch galvanized mesh.
   c. Horizontally mounted across hood intake area.
4. Options/Accessories:
   a. Roof Curbs:
      1) Flat Roofs:
         (a) Welded, straight side curb with flashing flange and wood nailer.
      2) Pitched Roofs: Welded, straight side curb with flashing flange and wood nailer.
   b. Curb Seal: Rubber seal between fan and roof curb.
   c. Dampers:
      1) Type: Gravity.
      2) Factory designed to prevent outside air from entering back into building when fan is off.
      3) Balanced for minimal resistance to flow.
      4) Galvanized frames with pre-punched mounting holes.

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PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black, see Section 09 9123.

END OF SECTION

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SECTION 23 7416
PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged rooftop air-conditioning units

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's technical product data indicating dimensions, weights, operating clearances, capacities, ratings, electrical characteristics, fan performance and all specialties/accessories as scheduled or specified.

C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clarances, construction details, field connection details, duct connections, electrical characteristics and connection requirements. Provide details of the mounting, securing and flashing of the roof curb to the roof structure, including coordinating requirements with the project specific roof system type.

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. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum five years of documented experience.

B. Designer Qualifications: Design curb, attachments of equipment to curb, and attachments of curb to roof structure under direct supervision of a Professional Engineer experienced in design of this work and licensed in Texas.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place and ready for immediate installation of units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Base Bid: Trane

B. Alternate 1A: Carrier

C. Alternate 1B: York

D. Alternate 1C: Daikin

2.02 GENERAL DESCRIPTION

A. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fan, return fan (if applicable), dampers, air-cooled condenser coils, condenser fans, reheat coil (if applicable), electric heater and unit controls.

B. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit.

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C. Unit nameplate data shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

D. All rooftop units shall be provided with a factory fabricated roof curb as specified elsewhere in this s

2.03 CASING

A. Cabinet: Zinc coated, heavy gauge, galvanized steel with baked enamel finish, including access doors with piano hinges and locking handle. Structural members to be minimum 18 gauge, 0.0478 inch, with access doors or panels of minimum 20 gauge, 0.0359 inch.

B. Insulation: 1/2-inch thick minimum, neoprene-coated glass fiber with edges protected from erosion.

C. Casing roof shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.

D. Access to filters, dampers, cooling coils, heaters, fans, energy recovery wheels, compressors and electrical/control components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

E. Exterior finish shall be capable of withstanding at least 1,000 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B117 test procedure.

F. Units with cooling coils shall include double sloped 304 stainless steel drain pans.

G. Units shall include factory installed, painted galvanized steel condenser coil guards on the face of the condenser coil.

2.04 FANS

A. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.

B. Blowers and motors shall be dynamically balanced. Isolate complete fan assembly.

C. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

D. Provide electronically commutated motors. Alternatively, provide variable frequency drive for motor control. VFD shall be factory wired and mounted in the unit.

2.05 BURNERS

A. Gas Burner: Induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, direct spark ignition, flame-sensing device, and automatic 100 percent shutoff pilot.
   1. Construction: Welded stainless steel.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.

C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature, and energize burner when temperature drops to lower safe value.

2.06 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.07 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.

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B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency electronically commutated motors for condenser fan control .

C. Provide refrigerant pressure switches to modulate condenser fans.

2.08 COMPRESSORS

A. Unit shall be factory charged with R-454B or R-32 refrigerant.

B. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.

C. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double-wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.

D. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.

E. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.

F. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed replaceable core liquid line filter drier.

G. Unit shall include a minimum of 2-stage of cooling for all units less than 6-tons and a minimum of 3-stages of cooling for all units 6-tons and greater. When available, provide a variable speed scroll compressor in lieu of staged compressors.

H. Unit shall include factory provided and installed compressor sound jackets on all compressors.

I. Lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

J. Each refrigeration circuit shall be equipped with a liquid line sight glass.

K. Each refrigeration circuit shall be equipped with suction and discharge compressor isolation valves.

L. Lag refrigeration circuit shall be provided with factory installed hot gas bypass to protect against evaporator frosting and to prevent excessive compressor cycling.

2.09 MIXED AIR CASING

A. Dampers: Provide outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper to fall to closed position. Relief dampers may be gravity balanced.

B. Gaskets: Provide tight fitting dampers with edge gaskets maximum leakage 5 percent at 2-inch pressure differential.

2.10 AIR FILTERS:

A. Unit shall include filter rack with 2 inch thick, pleated panel filters with an ASHRAE MERV rating of 13, upstream of the cooling coil.

B. Filter rack shall support standard 20x20 filter media size.

C. Unit shall include a clogged filter switch which will the notify the Building Controls System.

D. Unit shall include a Magnehelic gauge mounted in the controls compartment.

2.11 OPERATING CONTROLS

A. Provide with manufacturer's factory prewired unit controller. Controller shall be equipped with Bacnet card to allow integration into campus building automation system, by DDC contractor.

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Manufacturer shall provide full list of Bacnet points to aide DDC contractor in mapping of control points.

B. Unit shall be connected to, and controlled by, the Building Controls System.

C. Provide controls to meet sequence of operations indicated in contract drawings.

D. For each system with 2,000 CFM or greater airflow, provide and install UL listed ionization smoke detectors in the main return air duct, integral to the return of the unit, or where shown on the drawings. Smoke detectors furnished by Division 26. Connect the detectors into the control circuit to stop the fan in the event of the presence of smoke. Connection to Fire Alarm System by Division 26.
   1. System airflow includes the total airflow of all units serving any single space and all units connected to the same return air plenum.

2.12 PREFABRICATED ROOF CURBS

A. Furnish prefabricated roof curb designed to mate with the unit and provide support and a water tight installation when installed properly. The roof curb design shall allow field fabricated rectangular supply/return ductwork to be connected directly to the curb. Curb design shall comply with NRCA requirements.
   1. Roof curb height shall be minimum 18 inches.
   2. For sloped roof decks of 1/4 in. per foot or more, fabricate support units to form level top edge for unit mounting.

B. Roof curbs shall be constructed to support and secure unit to meet local wind and tornado load code requirements. Refer to Structural drawings for local design wind speed (V_ult), local design tornado speed (V_T) and Building Exposure Category. Each curb shall include wind restraint brackets to secure each unit to its curb, as well as base flange anchored to roof structure, to resist the wind and tornado loads. Refer to Structural Drawings for structure and angle framing being provided for each unit on the roof.

C. Contractor to provide detailed documents during submittal phase including calculations showing compliance with wind and tornado load requirements, attachment details, bolt/screw sizing and placement and any other details necessary to secure equipment to curb and curb to roof structure. Roof curb shop drawings and calculations shall be sealed by a licensed Engineer in Texas.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as required by manufacturer.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Install and secure roof curb to roof structure, in accordance with National Roofing Contractors Association (NRCA) installation recommendations and shop Drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.

3.03 SYSTEM STARTUP

A. Provide the services of a factory-authorized service representative to start-up rooftop units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

B. Operating and Maintenance Training:
   1. Provide services of manufacturer's service representative to instruct Owner's personnel in operation and maintenance of rooftop units. Training shall consist of a minimum of 8 hours, not necessarily consecutive, and shall include start-up and shutdown, servicing and

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preventative maintenance schedule and procedures, and troubleshooting procedures plus procedures for obtaining repair parts and technical assistance. Review operating and maintenance data contained in the Operating and Maintenance Manuals specified in Division 1.

2. Schedule training with Owner; provide at least 7-day prior notice to the Architect.
3. Provide a written report of training periods to Owner and Architect/Engineer.

END OF SECTION

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SECTION 23 8126.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Air cooled condensing units.

C. Indoor air handling (fan and coil) units for ductless systems.

D. Controls.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Errata (2023).

D. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mitsubishi

B. Daikin

C. LG

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator.
   2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

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2.03 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturer: System manufacturer.

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Comply with AHRI 210/240.
   2. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
   3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.

B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high-pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

D. Coil: Air-cooled, aluminum fins bonded to copper tubes.

E. Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

F. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.
   2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Install refrigeration systems in accordance with ASHRAE Std 15.

D. Pipe drain from cooling coils to nearest floor drain.

END OF SECTION

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SECTION 26 0500
GENERAL REQUIREMENTS, ELECTRICAL

PART 1 GENERAL

1.01 WORK INCLUDED

A. This section is applicable to and a part of all Division 26 sections of the Project Manual.

1.02 QUALITY ASSURANCE

A. Publications
   1. Copies: Obtain copies of trade association standards and publication wherever needed for proper execution of the work.
   2. Publication Date: Comply with the issue of applicable standard or publication which is in effect at the date shown on these contract documents. Obtain approval from the Architect-Engineer to comply with a later issue of a standard or publication.
   3. Conflicting Requirements: Report to the Architect-Engineer where application of a trade association standard or publication appears to be in conflict with the requirements of the contract documents.

B. Product Standards: Listed in the current edition of UL "Electrical Construction Materials Directory," or ETL if such a listing exists for the particular type of item specified.

C. Reference Standards:
   1. Meet or exceed the recommendations and requirements of reference standards.
   2. Submit proof (stamp, label, published listing or independent certified test).

D. Servicing: Provide products supported by a service organization that is reasonably convenient to the site.

E. Nameplates:
   1. Securely attach to each major component of equipment, visible and readable, name, address, and model identification number on a plate.
   2. Do not cover with paint, insulation, or other material.

F. Manufacturer's Instructions: Follow the manufacturer's published instructions in preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise indicated by the Contract Documents.

G. Capacities: Meet or exceed capacity requirements indicated. Stay within maximums, minimums and other limits. Prevent components or systems from becoming inoperative or damaged because of start-up, overload, or other conditions.

H. Suitability: Provide products suitable for the pressures, temperatures, fluids, voltages, environmental conditions, and other conditions encountered by the indicated application.

I. Protection from Moving Parts: Provide enclosures and guards for belts, pulleys, chains, gears, couplings, projecting set-screws, keys, hot surfaces and other hazardous parts located where persons can come in close proximity.

J. Spare Parts Data: Provide spare parts data prior to Substantial Completion.

K. Standard Products: Provide standard cataloged products of manufacturers regularly engaged in the manufacture of products that essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years.

L. Connections to Utilities:
   1. Provide the services of a person or company approved by the respective utility authority to make connections to:
      a. Water supplies.
      b. Sanitary sewer.
      c. Storm sewer.
      d. Gas.

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e. Electrical power.
f. Telephone.
g. Other utilities.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products of this type, and whose products have been in satisfactory use in similar service for not less than 5 years.
   1. Warranty:
   2. The Contractor shall warrant his work against defective materials and workmanship for a period of one year from the date of acceptance of the entire project, unless specific longer term is specified with Individual System Specification.
   3. Neither Final Payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
   4. The Owner shall give notice of observed defects with reasonable promptness.
   5. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

B. Submittals:
   1. Electrical Product Data Submittals to be organized and submitted as ONE complete submittal as follows (excludes shop drawings and electrical panel submittals):
      a. Cover Sheet listing project name, date, GC, Subcontractor
      b. Index Sheet
      c. The contractor shall include a formal letter to the engineer, included in the submittal after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
      d. Organize all required items by numerical specification section with tabbed dividers including section number and title. Each section to provide a subsequent index cover.
      e. Submittals not organized as indicated above may be rejected without review.
   2. The contractor may require his subcontractors to provide coordination drawings indicating all trades, such drawings will not be reviewed by the engineer.
   3. Shop drawings are to fully drawn/designed and coordinated by the contractor. Any replication of original bid documents will be rejected. Electronic shop drawings are NOT acceptable.

C. Project Record Documents:
   1. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the Building.
   2. Upon submitting request for Final Payment, Contractor shall turn over to the Architect-Engineer, for subsequent transmittal to the Owner, clean, neatly marked set of reproducible plans showing “as installed” work.
   3. In addition to the above, the Contractor shall accumulate during the Job’s progress the following data turned over to the Architect-Engineer for checking and subsequent delivery to the Owner:
      a. All warranties, guarantees and manufacturer’s direction on equipment and material covered by the Contract
      b. Approved fixture/equipment brochures
      c. Copies of approved Shop Drawings
      d. Set of operating instructions. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.
      e. Any and all data and/or plans required during construction.
      f. Repair parts lists of all major items and equipment including name, address and telephone number of the local supplier or agent.

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g. The first page or pages shall have the name, addresses and telephone numbers of the following; General Contractor and all sub-contractors, Major Equipment Suppliers.

D. Training:
1. Upon completion of the work and at a time designated by the Owner's representative, provide a formal training session for the Owner's operating personnel to include location, operation and maintenance of all the mechanical, electrical and plumbing equipment and systems.
2. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that will be covered. Submit the outline for review by the Owner's representative one week prior to training session.
3. At the conclusion of the instruction, obtain signatures of the attendees on each copy of the outline to signify that they have proper understanding of the operation and maintenance of the systems. Submit the signed outlines to the Owner's representative and Engineer as a condition of final acceptance.

E. Plans and Specifications:
1. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures and equipment and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system.
2. The Systems shall include, but are not limited to, the items shown on the plans.
3. Exact locations of these items shall be determined by reference to the general plans and measurements of the Building and in cooperation with other Contractors, and in all instances, shall be subject to the approval of the Architect-Engineer.
4. The Architect-Engineer reserves the right to make any reasonable change in the location of any part this work without additional cost to the Owner.

F. Utilities, Locations and Elevations:
1. Locations and elevations of the various utilities within this scope of work have been obtained from the City, Owner and/or other substantially reliable sources and are offered separately from the Contract Documents, as a general guide only, without any guarantees at to the accuracy.
2. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and the availability / characteristics (voltage/phase/pressure/capacity) of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids or proposals shall be deemed evidence thereof.
3. The Contractor shall coordinate all services with the respective Utility Company or Agency during construction; coordinate changes made by Utility Companies or Agencies to the design of the project, and coordinate with the Owner, Architect-Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
4. The Contractor shall verify location / depth / direction of flow, conduct all necessary tests, inspections, coordinate with Owner's representatives and Utilities, and check for existing underground utilities before ditching / trenching / drilling.
5. The Contractor shall be responsible for repair of any cut of damaged lines or utilities he uncovers and disrupts. There are lines and utilities not shown on the plans.

1.04 OBSERVATIONS

A. The Engineer reserves the right to review the work whenever advisable.

B. The Contractor shall have a representative present on each observation and shall give assistance as may be required to facilitate such observations or reviews.

C. The Engineer's field observation report is carried out in accordance with the General Conditions of the Contract for Construction and does not imply that the Engineer has made exhaustive or continuous on-site inspections. The Engineers report does not relieve the Contractor of responsibility from performing inspections on portions of the work to determine that such portions are in proper condition to receive subsequent work. Omission of nonconforming items

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within this report does not imply that the Engineer accepts work not in conformance with the Contract Documents.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle products carefully to prevent internal component damage, breaking or denting.

B. Store products in clean, dry space, protected from dirt, fumes, water, construction debris and physical damage.

C. Do not install damaged equipment or materials.

1.06 PRODUCT APPLICATION, INSTALLATION, AND OPERATION

A. General: For products incorporated into the Work, the Contractor shall ascertain the following:
   1. Application:
      a. The manufacturer's representatives have reviewed the proposed application of their products.
      b. The application and product are compatible regarding:
         1) Operation.
         2) Electric Source.
         3) Piping.
         4) Controls.
         5) Location.
         6) Proximity to other products and elements of the work.
         7) Structural support and integrity.
         8) Other pertinent factors.

B. Installation: The installers were instructed in the manufacturer's recommended procedure for installation, and the product was installed according to the manufacturer's recommendations.

C. Operation: The manufacturer's representative has witnessed and reviewed the product operation subsequent to system start-up, the products are operating as intended by the Contract Documents, and the application and product are compatible regarding the same factors named above.

D. Installation: Submit letter following installation of the manufacturer's product stating the following:
   1. The installers were instructed in the manufacturer's recommended procedure for installation.
   2. The product was installed according to the manufacturer's recommendations.

E. Operation: Submit letter with Owner's final documents stating the following:
   1. The manufacturer's representative has witnessed and reviewed the product operation subsequent to system start-up.
   2. The products are operating as intended by the Contract Documents.
   3. The application and product are compatible regarding the same factors named above.

F. Signature on Letter: By manufacturer's representative

PART 2 PRODUCTS

2.01 NOT USED

PART 3 EXECUTION

3.01 TESTING:

A. Reference individual sections for required testing.

END OF SECTION

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SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.
B. Underground feeder and branch-circuit cable.
C. Service entrance cable.
D. Armored cable.
E. Metal-clad cable.
F. Power and control tray cable.
G. Variable-frequency drive cable.
H. Manufactured wiring systems.
I. Wiring connectors.
J. Electrical tape.
K. Heat shrink tubing.
L. Oxide inhibiting compound.
M. Wire pulling lubricant.
N. Cable ties.
O. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
D. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.
E. Section 31 2316 - Excavation.
F. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).
B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.
C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).
F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).
G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.

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H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

J. FM 3971 - Examination Standard for Fire Protective Coatings and Wraps for Grouped Cables; 2023.

K. IEEE 383 - IEEE Standard for Qualifying Electric Cables and Splices for Nuclear Facilities; 2023.

L. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

M. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.

N. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

O. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2024.

P. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

Q. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

R. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

S. NFPA 79 - Electrical Standard for Industrial Machinery; 2024.

T. UL 4 - Armored Cable; Current Edition, Including All Revisions.

U. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

V. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

W. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

X. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

Y. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

Z. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

AA. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

BB. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

CC. UL 854 - Service-Entrance Cables; Current Edition, Including All Revisions.

DD. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

EE. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

FF. UL 2277 - Outline of Investigation for Flexible Motor Supply Cable and Wind Turbine Tray Cable; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the installation of direct burial cable with other trades to avoid conflicts with piping or other potential conflicts.

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3. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

C. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

D. Wire Pulling Lubricant: Certification of compatibility with conductors/cables where used with the following insulation/jacket types:

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
1. Exceptions:
   a. Use variable-frequency drive cable for connection between variable-frequency motor controllers and associated motors.

C. Nonmetallic-sheathed cable is not permitted.

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2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

I. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
         1) Services: Copper conductors size 1/0 AWG and larger.
         2) Feeders: Copper conductors size 1/0 AWG and larger.
      b. Where aluminum conductors are substituted for copper, comply with the following:
         1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
         2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.
   4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

J. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
   2. Control Circuits: 14 AWG.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.

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2) Phase B: Orange.
3) Phase C: Yellow.
4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

c. 240/120 V High-Leg Delta, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B (High-Leg): Orange.
3) Phase C: Blue.
4) Neutral/Grounded: White.

d. 240/120 V, 1 Phase, 3 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Neutral/Grounded: White.

e. Equipment Ground, All Systems: Green.
f. Isolated Ground, All Systems: Green with yellow stripe.
g. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
1. Copper Building Wire:
a. Encore Wire Corporation: www.encorewire.com/#sle.
b. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
c. Service Wire Co: www.servicewire.com/#sle.
d. Southwire Company: www.southwire.com/#sle.
2. Aluminum Building Wire (only where specifically indicated or permitted for substitution):
a. Encore Wire Corporation: www.encorewire.com/#sle.
b. Southwire Company: www.southwire.com/#sle.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
a. Size 10 AWG and Smaller: Solid.
b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Size 4 AWG and Larger: Type XHHW-2.
b. Installed Underground: Type XHHW-2.
2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.04 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

A. Manufacturers:
1. Cerro Wire LLC: www.cerrowire.com/#sle.
2. Encore Wire Corporation: www.encorewire.com/#sle.
3. Service Wire Co: www.servicewire.com/#sle.
4. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.

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C. Provide equipment grounding conductor unless otherwise indicated.

D. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

E. Insulation Voltage Rating: 600 V.

2.05 SERVICE ENTRANCE CABLE

A. Manufacturers:
   1. Copper Service Entrance Cable:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.
      c. Southwire Company: www.southwire.com/#sle.
   2. Aluminum Service Entrance Cable:
      a. Encore Wire Corporation: www.encorewire.com/#sle.
      b. Southwire Company: www.southwire.com/#sle.

B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 600 V.

2.06 ARMORED CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type AC cable listed and labeled as complying with UL 4, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN.

F. Grounding: Combination of interlocking armor and integral bare bonding wire.

G. Armor: Steel, interlocked tape.

2.07 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Service Wire Co: www.servicewire.com/#sle.
   4. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.

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G. Armor: Steel, interlocked tape.

2.08 POWER AND CONTROL TRAY CABLE

A. Manufacturers:
   1. Encore Wire Corporation: www.encorewire.com/#sle.
   2. Service Wire Co: www.servicewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type XHHW or XHHW-2.

F. Grounding: Full-size integral equipment grounding conductor.

G. Provide metallic shield.

H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.09 VARIABLE-FREQUENCY DRIVE CABLE

A. Manufacturers:
   1. Service Wire Co; ServiceDrive: www.servicewire.com/#sle.

B. Description: Flexible motor supply cable listed and labeled as complying with UL 2277 in accordance with NFPA 79; specifically designed for use with variable frequency drives and associated nonlinear power distortions.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 1000 V.

E. Insulation: Use only thermoset insulation types; thermoplastic insulation types are not permitted.

F. Grounding: Full-size integral equipment grounding conductor or symmetrical arrangement of multiple conductors of equivalent size.

G. Provide metallic shielding.

H. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.10 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
   3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.

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5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Aluminum Conductors: Use compression connectors for all connections.
7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
8. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Ideal Industries, Inc: www.idealindustries.com/#sle.
c. NSI Industries LLC: www.nsiindustries.com/#sle.

H. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.11 ACCESSORIES

A. Electrical Tape:
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.

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6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Burndy LLC: www.burndy.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.
b. Ideal Industries, Inc: www.idealindustries.com/#sle.
c. Ilsco: www.ilsco.com/#sle.

D. Wire Pulling Lubricant:
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. American Polywater Corporation: www.polywater.com/#sle.
c. Ideal Industries, Inc: www.idealindustries.com/#sle.
2. Listed and labeled as complying with UL 267.
3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
4. Suitable for use at installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.
1. Manufacturers:
a. Burndy LLC: www.burndy.com/#sle.

F. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
1. Products:
a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

G. Fire-Protective Coating for Electrical Conductors and Cables: Field-applied, intumescent or ablative coating designed to prevent ignition and propagation of fire along thermoplastic-insulated conductors and cables.
1. Pass flammability tests of one of the following:
a. ASTM E84, Class A; maximum flame spread index of 25.
b. FM 3971.
c. IEEE 383.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

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3.02 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
   5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
   8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
   9. Provide oversized neutral/grounded conductors where indicated and as specified below.
      a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
      b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.

F. Install armored cable (Type AC) in accordance with NECA 120.

G. Install metal-clad cable (Type MC) in accordance with NECA 120.

H. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
   4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

I. Exposed Cable Installation (only where specifically permitted):
   1. Route cables parallel or perpendicular to building structural members and surfaces.
   2. Protect cables from physical damage.

J. Direct Burial Cable Installation:
   1. Provide trenching and backfilling in accordance with Section 31 2316 - Excavation and Section 31 2323 - Fill.
   2. Install cable with minimum cover of 24 inches unless otherwise indicated or required.
   3. Protect cables from damage in accordance with NFPA 70.
   4. Provide underground warning tape in accordance with Section 26 0553 along entire cable length.

K. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

L. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent

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support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

M. Terminate cables using suitable fittings.
1. Armored Cable (Type AC):
   a. Use listed fittings and anti-short, insulating bushings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
2. Metal-Clad Cable (Type MC):
   a. Use listed fittings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

N. Variable-Frequency Drive Cable: Terminate shielding at both variable-frequency motor controller and associated motor using glands or termination kits recommended by manufacturer.

O. Install conductors with a minimum of 12 inches of slack at each outlet.

P. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

Q. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

R. Make wiring connections using specified wiring connectors.
1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

S. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
   a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.

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b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.

T. Insulate ends of spare conductors using vinyl insulating electrical tape.

U. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

V. Identify conductors and cables in accordance with Section 26 0553.

W. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

X. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.
B. Conductors for grounding and bonding.
C. Connectors for grounding and bonding.
D. Ground bars.
E. Ground rod electrodes.
F. Chemically-enhanced ground electrodes.
G. Ground plate electrodes.
H. Ground enhancement material.
I. Ground access wells.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   1. Includes oxide inhibiting compound.
B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.
C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. NFPA 99 - Health Care Facilities Code; 2021, with Amendment.
F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

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D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field quality control test reports.

F. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:
1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Grounding Electrode System:
1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
   a. Provide continuous grounding electrode conductors without splice or joint.
   b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
3. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
4. Ground Ring:
   a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
5. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.

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b. Space electrodes not less than 10 feet from each other and any other ground electrode.
c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.

6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
   a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
   b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
   c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
2. Provide equipment grounding conductor routed with supply conductors.
3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.

H. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
   a. Transformers (except autotransformers such as buck-boost transformers).
   b. Generators, when neutral is switched in the transfer switch.
2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

I. Bonding and Equipment Grounding:

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1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
   c. Metal process piping.
8. Provide bonding for metal building frame.
9. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
10. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.

J. Isolated Ground System:
   1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.
   2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
   3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

K. Communications Systems Grounding and Bonding:
   1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
   2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
      a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
      b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
      c. Ground Bar Size: 1/4 by 4 by 20 inches unless otherwise indicated or required.
      d. Ground Bar Mounting Height: 72 inches above finished floor unless otherwise indicated.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
   1. Use insulated copper conductors unless otherwise indicated.

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a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
4. Manufacturers - Mechanical and Compression Connectors:
a. allG Fabrication: www.allgfab.com/#sle.
b. Burndy LLC: www.burndy.com/#sle.
c. Harger Lightning & Grounding: www.harger.com/#sle.
d. nVent ERICO: www.nvent.com/#sle.
e. Thomas & Betts Corporation: www.tnb.com/#sle.
5. Manufacturers - Exothermic Welded Connections:
a. Burndy LLC: www.burndy.com/#sle.
b. nVent ERICO; Cadweld: www.nvent.com/#sle.
c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
a. Harger Lightning & Grounding: www.harger.com/#sle.
b. nVent ERICO: www.nvent.com/#sle.
c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Manufacturers:
a. allG Fabrication: www.allgfab.com/#sle.
b. Galvan Industries, Inc: www.galvanelectrical.com/#sle.
c. Harger Lightning & Grounding: www.harger.com/#sle.
d. nVent ERICO: www.nvent.com/#sle.

F. Chemically-Enhanced Ground Electrodes:
1. Description: Copper tube factory-filled with electrolytic salts designed to provide a low-impedance ground in locations with high soil resistivity; straight (for vertical installations) or L-shaped (for horizontal installations) as indicated or as required.
2. Length: 10 feet.
3. Integral Pigtail: Factory-attached, sized not less than grounding electrode conductor to be attached.
4. Backfill Material: Grounding enhancement material recommended by electrode manufacturer.
5. Manufacturers:
a. allG Fabrication: www.allgfab.com/#sle.

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b. Harger Lightning & Grounding: www.harger.com/#sle.
c. nVent ERICO: www.nvent.com/#sle.
d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

G. Ground Plate Electrodes:
1. Material: Copper.
2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.
3. Manufacturers:
a. allG Fabrication: www.allgfab.com/#sle.
b. Harger Lightning & Grounding: www.harger.com/#sle.
c. nVent ERICO: www.nvent.com/#sle.
d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

H. Ground Enhancement Material:
1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
2. Resistivity: Not more than 20 ohm-cm in final installed form.
3. Manufacturers:
a. Harger Lightning & Grounding: www.harger.com/#sle.
b. nVent ERICO; GEM: www.nvent.com/#sle.
c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

I. Ground Access Wells:
1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
a. Round Wells: Not less than 8 inches in diameter.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.
4. Cover: Factory-identified by permanent means with word "GROUND".
5. Manufacturers:
a. allG Fabrication: www.allgfab.com/#sle.
b. Harger Lightning & Grounding: www.harger.com/#sle.
c. nVent ERICO: www.nvent.com/#sle.
d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury

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horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.

E. Make grounding and bonding connections using specified connectors.
1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

F. Identify grounding and bonding system components in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

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SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

B. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

C. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

D. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

E. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

B. Installer Qualifications for Powder-Actuated Fasteners: Certified by fastener system manufacturer with current operator's license.

C. Installer Qualifications for Field Welding: See Section 05 5000.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

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PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. NFPA 70.
      b. Applicable building code.
      c. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. nVent; Caddy: www.nvent.com/#sle.
   2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   3. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. nVent; Caddy: www.nvent.com/#sle.

D. Metal Channel/Strut Framing Systems:
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
      c. Eaton Corporation: www.eaton.com/#sle.
      d. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.
   2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
   3. Comply with MFMA-4.

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4. Channel Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
6. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2-inch diameter.
   b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
   c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
   d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
   e. Outlet Boxes: 1/4-inch diameter.
   f. Luminaires: 1/4-inch diameter.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
   a. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
   b. Eaton Corporation: www.eaton.com/#sle.
   c. nVent; Caddy: www.nvent.com/#sle.
2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

G. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
   a. Dewalt: anchors.dewalt.com/#sle.
   b. Hilti, Inc: www.hilti.com/#sle.
   c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Dewalt: anchors.dewalt.com/#sle.
   b. Hilti, Inc: www.hilti.com/#sle.
   c. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
3. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
4. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
   b. Comply with MFMA-4.
   c. Channel Material: Use galvanized steel.
   d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
5. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

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C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Conduit Support and Attachment: See Section 26 0533.13 for additional requirements.

J. Box Support and Attachment: See Section 26 0533.16 for additional requirements.

K. Interior Luminaire Support and Attachment: See Section 26 5100 for additional requirements.

L. Exterior Luminaire Support and Attachment: See Section 26 5600 for additional requirements.

M. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

N. Secure fasteners in accordance with manufacturer's recommended torque settings.

O. Remove temporary supports.

P. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Galvanized steel intermediate metal conduit (IMC).
D. PVC-coated galvanized steel rigid metal conduit (RMC).
E. Flexible metal conduit (FMC).
F. Liquidtight flexible metal conduit (LFMC).
G. Galvanized steel electrical metallic tubing (EMT).
H. Stainless steel electrical metallic tubing (EMT).
I. Aluminum electrical metallic tubing (EMT).
J. Rigid polyvinyl chloride (PVC) conduit.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 07 8400 - Firestopping.
C. Section 26 0526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.
D. Section 26 0529 - Hangers and Supports for Electrical Systems.
E. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.
F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
G. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
H. Section 31 2316 - Excavation.
I. Section 31 2323 - Fill: Bedding and backfilling.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2025.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit - Aluminum (ERMC-A); 2025.
D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2025.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.
I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

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L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

O. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

P. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

Q. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

R. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

S. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

T. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

U. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

V. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.

W. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

X. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.05 QUALITY ASSURANCE

A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), or rigid PVC conduit.
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), or rigid PVC conduit.
4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), aluminum electrical metallic tubing (EMT), or schedule 80 rigid PVC conduit where emerging from underground.
5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, galvanized steel intermediate metal conduit (IMC) elbows, PVC-coated galvanized steel rigid metal conduit (RMC) elbows, or concrete-encased PVC elbows for bends.
6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

D. Embedded Within Concrete:
1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), or rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.
2. Within Slab Above Ground: Not permitted.
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or aluminum electrical metallic tubing (EMT) where emerging from concrete.
5. Where galvanized steel electrical metallic tubing (EMT) emerges from concrete into salt air, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.
6. Where aluminum rigid metal conduit (RMC) and aluminum electrical metallic tubing (EMT) is installed in concrete, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

E. Concealed Within Masonry Walls: Use galvanized steel electrical metallic tubing (EMT) or aluminum electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel electrical metallic tubing (EMT) or aluminum electrical metallic tubing (EMT).

G. Concealed Above Accessible and Non-Accessible Ceilings: Use aluminum electrical metallic tubing (EMT).

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H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel electrical metallic tubing (EMT) or aluminum electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC) or aluminum rigid metal conduit (RMC).
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

K. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

L. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

M. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

N. Flexible Connections to Luminaires Above Accessible and Non-Accessible Ceilings: Use flexible metal conduit (FMC).
   1. Maximum Length: 6 feet.

O. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Electrical Service Conduits: See Section 26 2100 for additional requirements.

C. Fittings for Grounding and Bonding: See Section 26 0526 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4-inch trade size.
   2. Branch Circuit Homeruns: 3/4-inch trade size.
   3. Control Circuits: 1/2-inch trade size.
   4. Flexible Connections to Luminaires: 3/8-inch trade size.
   5. Underground, Interior: 3/4-inch trade size.
   6. Underground, Exterior: 1-inch trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Rymco USA: www.rymcousa.com/#sle.
   4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

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B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Factory-Painted, Color-Coded Galvanized Steel RMC: Apply according to indicated color code.
   1. See Section 26 0553 for color code.

D. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
      c. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   3. Material: Use steel or malleable iron.
      a. Where not subject to severe corrosive influence, stainless steel or aluminum fittings may be used.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Rymco USA: www.rymcousa.com/#sle.
   4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
      c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
   3. Material: Use aluminum.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Rymco USA: www.rymcousa.com/#sle.
   4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.

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c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. ABB; Ocal: www.electrification.us.abb.com/#sle.
2. Calbond, a division of Atkore International www.calbond.com/#sle
3. Robroy Industries: www.robroy.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.

D. PVC-Coated Boxes and Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
3. Material: Use steel or malleable iron.
4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.07 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
2. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:
1. Manufacturers:
a. ABB; T&B: www.electrification.us.abb.com/#sle.
b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. International Metal Hose: www.metalhose.com/#sle.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
1. Manufacturers:
a. ABB; T&B: www.electrification.us.abb.com/#sle.
b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.

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c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

2.09 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
2. Nucor Tubular Products: www.nucortubular/#sle.
3. Rymco USA: www.rymcousa.com/#sle.
4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Factory-Painted, Color-Coded Galvanized Steel EMT: Apply according to indicated color code.
1. See Section 26 0553 for color code.
2. Products:
a. Rymco USA; Real Color: www.rymcousa.com/#sle.

D. Fittings:
1. Manufacturers:
a. ABB; T&B: www.electrification.us.abb.com/#sle.
b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use compression/gland type.
a. Do not use indenter type connectors and couplings.
b. Do not use set-screw type connectors and couplings.
5. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.10 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.

B. Fittings:
1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Connectors and Couplings: Use compression/gland type.
a. Do not use set-screw type connectors and couplings.

2.11 ALUMINUM ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
1. American Conduit, a division of Hydro: www.americanconduit.com/#sle.

B. Description: NFPA 70, Type EMT aluminum electrical metallic tubing listed and labeled as complying with UL 797A.

C. Fittings:
1. Manufacturers:
a. Arlington Industries: www.aifittings.com/#sle.
b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; listed for use with aluminum EMT.
3. Material: Use aluminum.
4. Connectors and Couplings: Use compression/gland type.
   a. Do not use indenter type connectors and couplings.
   b. Do not use set-screw type connectors and couplings.
5. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.12 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. ABB; Carlon: www.carlon.com/#sle.
   2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   3. Cantex Inc: www.cantexinc.com/#sle.
   4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com/#sle.
   5. JM Eagle: www.jmeagle.com/#sle.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.13 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

E. Foam Conduit Sealant:
   1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
   2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
   3. Rated to hold minimum of 10 ft water head pressure.
   4. Products:
      a. American Polywater Corporation; Polywater AFT Foam Duct Sealant: www.polywater.com/#sle.
      b. American Polywater Corporation; Polywater FST Foam Duct Sealant: www.polywater.com/#sle.

F. Conduit Mechanical Seals:
   1. Listed as complying with UL 514B.
   2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
   3. Suitable for sealing around conductors/cables to be installed.
   4. Products:
      a. American Polywater Corporation; PHRD SG Mechanical Seals: www.polywater-haufftechnik.com/#sle.

G. Sealing Systems for Concrete Penetrations:

1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
3. Products:
   a. American Polywater Corporation; PZVR Cement-Coated Concrete Wall Sleeves: www.polywater-haufftechnik.com/#sle.
   b. American Polywater Corporation; PHSD Mechanical Seals: www.polywater-haufftechnik.com/#sle.
   c. American Polywater Corporation; PHSI 150 Varia Double Wall Inserts: www.polywater-haufftechnik.com/#sle.
   d. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.

H. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
   1. Products:
      a. Alta Products, LLC; Sigrist Pipe Chase Housing, Curbs, and Exit Seals: www.altaproductsllc.com/#sle.
      b. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
      c. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

I. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
   1. Products:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
   1. Products:
      a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

K. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.

E. Install intermediate metal conduit (IMC) in accordance with NECA 101.

F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.

G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

H. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
   a. Electrical rooms.
   b. Mechanical equipment rooms.
   c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route exposed conduits:
   a. Across floors.
   b. Across roofs.
   c. Across top of parapet walls.
   d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
   a. Heaters.
   b. Hot water piping.
   c. Flues.
14. Group parallel conduits in same area on common rack.

I. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 0529.
2. Provide required vibration isolation and/or seismic controls; see Section 26 0548.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
5. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
6. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.

10. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceiling and for fastening raceways to trapeze supports.
11. Use of wire for support of conduits is not permitted.

J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

K. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Provide metal escutcheon plates for conduit penetrations exposed to public view.
8. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 8400.

L. Underground Installation:
1. Provide trenching and backfilling; see Section 31 2316 and Section 31 2323.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 18 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 0553.

M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 3000.

N. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.

3. Where conduits are subject to earth movement by settlement or frost.

O. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
a. Where conduits enter building from outside.
b. Where service conduits enter building from underground distribution system.
c. Where conduits enter building from underground.
d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
a. Where conduits pass from outdoors into conditioned interior spaces.
b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
c. Where conduits penetrate coolers or freezers.

P. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

Q. Provide grounding and bonding; see Section 26 0526.

R. Identify conduits; see Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

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SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Floor boxes.

E. Underground boxes/enclosures.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

E. Section 26 2726 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Additional requirements for locating boxes for wiring devices.

F. Section 27 1000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCTE 77 - Specifications for Underground Enclosure Integrity; 2017.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

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1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

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B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
   12. Minimum Box Size, Unless Otherwise Indicated:
      a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
      b. Communications Systems Outlets: Comply with Section 27 1000.
      c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
   13. Wall Plates: Comply with Section 26 2726.
   14. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com/#sle.
      c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com/#sle.
      d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      e. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
   3. Junction and Pull Boxes Larger Than 100 cubic inches:
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
   4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
      a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
      b. Back Panels: Painted steel, removable.
      c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
   5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
   6. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
      c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.

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D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
   1. Manufacturers:
      a. Hubbell Incorporated: www.hubbell.com/#sle.

E. Floor Boxes:
   1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
   2. Manufacturer: Same as manufacturer of floor box service fittings.

F. Underground Boxes/Enclosures:
   1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
   2. Size: As indicated on drawings.
   3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
   4. Applications:
      a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
      b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
      c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
   5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
      a. Manufacturers:
         1) MacLean Highline: www.macleanhighline.com/#sle.
         2) Oldcastle Precast, Inc: www.oldcastleprecast.com/#sle.
      b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
      c. Product(s):
         1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
         2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
         3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.

2.02 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
   1. Manufacturers:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

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B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
      b. Communications Systems Outlets: Comply with Section 27 1000.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
   9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
   11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.

H. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.

2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

L. Install boxes as required to preserve insulation integrity.

M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

N. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

O. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
3. Provide cast-in-place concrete collar constructed in accordance with Section 03 3000, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

R. Close unused box openings.

S. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

T. Provide grounding and bonding in accordance with Section 26 0526.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0548
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 01 4533 - Code-Required Special Inspections and Procedures.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

D. Shop Drawings - Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
   2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Field quality control test reports.

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1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation:
   1. Transformers:
      a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.
      b. Floor-Mounted Transformers, Nonseismic Applications: Use resilient material isolator pads, resilient material isolator mounts, or open (unhoused) spring isolators.
      c. Suspended Transformers, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
      d. Wall-Mounted Transformers, Nonseismic Applications: Use resilient material isolator mounts.
      e. Minimum Static Deflection:
         1) Transformers Mounted on Grade-Level Slabs: 0.25 inch deflection unless otherwise indicated.
         2) Transformers Mounted at Above-Grade Levels: 0.5 inch deflection unless otherwise indicated.
   2. Engine Generators:
      a. Specified vibration isolators are in addition to any factory-installed internal vibration isolators between generator set and integral base unless otherwise indicated; obtain generator set manufacturer approval of applied vibration isolation.
      b. Nonseismic Applications, Isolators Not Located Below Sub-Base Fuel Tank: Use housed spring isolators or restrained spring isolators.
      c. Nonseismic Applications, Isolators Located Below Sub-Base Fuel Tank: Use restrained spring isolators.
      d. Minimum Static Deflection:
         1) Generators Mounted on Grade-Level Slabs: 1 inch deflection unless otherwise indicated.

E. Conduit Isolation:
   1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.
      a. Minimum Length: 3 feet unless otherwise indicated.
   2. Vibration Isolators:

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a. Provide vibration isolators for conduit supports:
   1) For conduits over 2 inch trade size located below or within 50 feet of noise-sensitive areas indicated.
b. Minimum Static Deflection:
   1) First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
c. Suspended Conduits, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
d. Use modular seal or approved resilient material where vibration-isolated conduits penetrate building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
   1. Vibration-Isolated Equipment Support Bases:
      a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      b. Mason Industries: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
   2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration-Isolated Structural Steel Bases:
   1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.

C. Vibration-Isolated Concrete Inertia Bases:
   1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
   2. Minimum Base Depth: 6 inches.
   3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
   4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
   5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 3000.

2.03 VIBRATION ISOLATORS

A. Manufacturers:
   1. Vibration Isolators:
      a. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
      b. Mason Industries: www.mason-ind.com/#sle.
      c. Vibration Eliminator Company, Inc: www.veco-nyc.com/#sle.
   2. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:
   1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
   2. Spring Elements for Spring Isolators:
      a. Color code or otherwise identify springs to indicate load capacity.
      b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
      c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
      d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.

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e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
f. Selected to function without undue stress or overloading.

C. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Nonseismic:
a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
3. Open (Unhoused) Spring Isolators:
a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
c. Furnished with integral leveling device for positioning and securing supported equipment.
4. Housed Spring Isolators:
a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
d. Furnished with integral leveling device for positioning and securing supported equipment.
5. Restrained Spring Isolators, Nonseismic:
a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
b. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
c. Furnished with integral leveling device for positioning and securing supported equipment.
d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Nonseismic:
a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.
7. Spring Isolator Hangers, Nonseismic:
a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 4533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Secure fasteners according to manufacturer's recommended torque settings.

E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Vibration Isolation Systems:
1. Vibration-Isolated Equipment Support Bases:
a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
a. Position equipment at operating height; provide temporary blocking as required.
b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:

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a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.

4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:
1. Verify isolator static deflections.
2. Verify required clearance beneath vibration-isolated equipment support bases.
3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

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SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting.

B. Section 09 9123 - Interior Painting.

C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

D. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.

E. Section 26 2726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

F. Section 27 1000 - Structured Cabling: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Switchboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      b. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      c. Transformers:
         1) Identify kVA rating.
         2) Identify voltage and phase for primary and secondary.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify load(s) served. Include location when not within sight of equipment.
      d. Enclosed switches, circuit breakers, and motor controllers:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.
         3) Identify load(s) served. Include location when not within sight of equipment.
      e. Time Switches:
         1) Identify load(s) served and associated circuits controlled. Include location.
      f. Enclosed Contactors:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
         4) Identify coil voltage.
         5) Identify load(s) and associated circuits controlled. Include location.
      g. Transfer Switches:
         1) Identify voltage and phase.
         2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
         3) Identify load(s) served. Include location when not within sight of equipment.

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4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

h. Electricity Meters:
1) Identify load(s) metered.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.
b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.

3. Emergency System Equipment:
a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.

4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.

5. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.

6. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

7. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.

8. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.

9. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

10. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 9123 and 09 9113.

11. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
a. Service equipment.
b. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.

12. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.

13. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
   a. At each source and load connection.
   b. Within boxes when more than one circuit is present.
   c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
5. Use underground warning tape to identify direct buried cables.

C. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.
   a. Maximum Intervals: 20 feet.
   b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      1) Field-Painting: Comply with Section 09 9123 and 09 9113.
      2) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.
   c. Color Code:
      1) Emergency Power System: Red.
      2) Fire Alarm System: Red.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.
6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

D. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
   a. Color-Coded Boxes: Field-painted in accordance with Section 09 9123 and 09 9113 per the same color code used for raceways.
   b. For exposed boxes in public areas, do not color code.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
   a. For exposed boxes in public areas, use only identification labels.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

E. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 1000.
2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
3. Factory Pre-Marked Wallplates: Comply with Section 26 2726.
4. Use identification label to identify fire alarm system devices.
   a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
5. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.

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a. For receptacles in areas as directed by Architect, provide identification on inside surface of wallplate.

6. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
7. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

F. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
a. Brimar Industries, Inc: www.brimar.com/#sle.
b. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
c. Seton Identification Products: www.seton.com/#sle.
2. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
a. Brady Corporation: www.bradyid.com/#sle.
b. Brother International Corporation: www.brother-usa.com/#sle.
c. Panduit Corp: www.panduit.com/#sle.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
a. System designation where applicable:
1) Emergency Power System: Identify with text "EMERGENCY".
2) Fire Alarm System: Identify with text "FIRE ALARM".
b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
a. System Designation: 1 inch.
b. Equipment Designation: 1/2 inch.
5. Color:
a. Normal Power System: White text on black background.
b. Emergency Power System: White text on red background.
c. Fire Alarm System: White text on red background.

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D. Format for General Information and Operating Instructions:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/4 inch.
   5. Color: Black text on white background unless otherwise indicated.
      a. Exceptions:
         1) Provide white text on red background for general information or operational instructions for emergency systems.
         2) Provide white text on red background for general information or operational instructions for fire alarm systems.

E. Format for Caution and Warning Messages:
   1. Minimum Size: 2 inches by 4 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/2 inch.
   5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Power source and circuit number or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Black text on clear background.

G. Format for Control Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Load controlled or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Designation indicated and device zone or address.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradyid.com/#sle.
   2. HellermannTyton: www.hellermanntyton.com/#sle.
   3. Panduit Corp: www.panduit.com/#sle.

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
a. Emergency Power System: Text "EMERGENCY".

F. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

E. Legend: Type of service, continuously repeated over full length of tape.

F. Color:

2.06 FLOOR MARKING TAPE

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Insite Solutions, LLC: www.stop-painting.com/#sle.
4. Seton Identification Products: www.seton.com/#sle.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

A. Manufacturers:
1. Brimar Industries, Inc: www.brimar.com/#sle.
2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
3. Insite Solutions, LLC: www.stop-painting.com/#sle.
4. Seton Identification Products: www.seton.com/#sle.

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B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

E. Floor Signs:
   1. Materials: Use factory preprinted, self-adhesive vinyl, polyester, or rubber labels with protective overlaminate; removable.
   2. Minimum Size: 17-inch diameter unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.
   3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
   4. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conduits: Legible from the floor.
   8. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.
   10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

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B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

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SECTION 26 0573
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.
   1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 26 2100 - Low-Voltage Electrical Service Entrance.
   1. Includes Utility Company contact information.

C. Section 26 2413 - Switchboards.

D. Section 26 2416 - Panelboards.

E. Section 26 2816.13 - Enclosed Circuit Breakers.

F. Section 26 3533.16 - Low-Voltage Power Factor Correction Equipment.

1.03 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 00001 - Motors and Generators; 2024.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
   2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

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1. Submit study reports prior to or concurrent with product submittals.
2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Study preparer's qualifications.

C. Field testing agency's qualifications.

D. Study reports, stamped or sealed and signed by study preparer.

E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
   1. Include characteristic time-current trip curves for protective devices.
   2. Include impedance data for busway.
   3. Include impedance data for engine generators.
   4. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
   5. Identify modifications made in accordance with studies that:
      a. Can be made at no additional cost to Owner.
      b. As submitted will involve a change to the contract sum.

F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

G. Site-specific arc flash hazard warning labels.

H. Field quality control reports.

I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

J. Project Record Documents: Revise studies as required to reflect as-built conditions.
   1. Include hard copies with operation and maintenance data submittals.
   2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.06 POWER SYSTEM STUDIES

A. Scope of Studies:
   1. Perform analysis of new electrical distribution system as indicated on drawings.
   2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
   3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
      a. Known Operating Modes:
         1) Utility as source.
         2) Generator as source.

B. General Study Requirements:
   1. Comply with NFPA 70.
   2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
        1) Obtain up-to-date information from Utility Company.
        2) Utility Company: See Section 26 2100 for Utility Company contact information.
    b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
    c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 00001 code letter designation.
    d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
    e. Protective Devices:
        1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
        2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
    f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
    g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    a. Maximum utility fault currents.
    b. Maximum motor contribution.
    c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.

F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
    a. Maximum and minimum utility fault currents.
    b. Maximum and minimum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:
1. General Requirements:
a. Identify date of study and study preparer.
b. Identify study methodology and software product(s) used.
c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d. Identify base used for per unit values.
e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
f. Include conclusions and recommendations.
2. Short-Circuit Study:
a. For each scenario, identify at each bus location:
1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
2) Fault point X/R ratio.
3) Associated equipment short circuit current ratings.
b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
3. Protective Device Coordination Study:
a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
b. For each graph include (where applicable):
1) Partial single-line diagram identifying the portion of the system illustrated.
2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
3) Conductors: Damage curves.
4) Transformers: Inrush points and damage curves.
5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
6) Motors: Full load current, starting curves, and damage curves.
7) Capacitors: Full load current and damage curves.
c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
2) Include ground fault pickup and delay.
3) Include fuse ratings.
4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
a. For the worst case for each scenario, identify at each bus location:
1) Calculated incident energy and associated working distance.
2) Calculated arc flash boundary.
3) Bolted fault current.
4) Arcing fault current.
5) Clearing time.
6) Arc gap distance.

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b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.07 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.
   1. Study preparer may be employed by field testing agency.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
   1. Products:
      a. EasyPower LLC: www.easypower.com/#sle.
      b. ETAP/Operation Technology, Inc: www.etap.com/#sle.
      c. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
   1. Materials: Comply with Section 26 0553.
   2. Minimum Size: 4 by 6 inches.
   3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
      a. Include orange header that reads "WARNING" unless otherwise indicated.
      b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
      c. Include the following information:
         1) Arc flash boundary.
         2) Available incident energy and corresponding working distance.
         3) Site-specific PPE (personnel protective equipment) requirements.
         4) Nominal system voltage.
         5) Equipment identification.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 0553.

3.02 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

E. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.03 CLOSEOUT ACTIVITIES

A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.

1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
2. Provide minimum of eight hours of training.
3. Instructor: Representative of entity performing study.

END OF SECTION

SECTION 26 0583
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0533.13 - Conduit for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 2726 - Wiring Devices.

E. Section 26 2816.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

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3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 2816.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 2726.

D. Flexible Conduit: As specified in Section 26 0533.13.

E. Wire and Cable: As specified in Section 26 0519.

F. Boxes: As specified in Section 26 0533.16.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION

SECTION 26 0800
ELECTRICAL SYSTEMS COMMISSIONING

GENERAL

1.01 DESCRIPTION

A. Commissioning
   1. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:
      a. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
      b. Verify and document proper performance of equipment and systems.
      c. Verify that Systems O&M documentation is complete.

B. The systems to be commissioned include (if included in project): emergency power systems, UPS Systems, and electrical and lighting controls.

C. Commissioning requires the participation of affected Division contractors to ensure that all systems are operating in a manner consistent with the Contract Documents. All affected Division contractors shall be familiar with all parts of the commissioning plan issued by the CA (Commissioning Authority) and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

D. Commissioning Team: The members of the commissioning team consist of the Commissioning Authority (CA), the designated representative of the owner, the General Contractor (GC or Contractor), the Architect and Design Engineers, the Mechanical Contractor (MC), the Electrical Contractor (EC), the Controls Contractor (CC), the Fire Alarm Contractor, and any other installing subcontractors or suppliers of equipment. The Owner's building or plant operator/engineer is also a member of the commissioning team.

1.02 COMMISSIONING AUTHORITY

A. The commissioning authority and/or agency shall be selected and employed by the building owner. The commissioning agent shall be a registered design professional with experience in the commissioning of mechanical and electrical systems of the type installed in this project. Experience in construction process, direct digital control systems, test and balance and current edition ASHRAE Guideline 0 is mandatory. The commissioning agent shall not be associated with or employed by a mechanical contractor, or equipment supplier.

1.03 COMMISSIONING PLAN

A. Commissioning Plan
   1. The commissioning plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will provide the plan, which will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.

B. Commissioning Process
   1. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
      a. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
      b. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems. Generally, these meetings will be included with or will be sequential with regular subcontractor meetings.

c. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.
d. The CA works with the Subs in developing startup plans and startup documentation formats, including verification checklists to be completed, during the startup process.
e. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with pre-functional checklists being completed before functional testing.
f. The Subcontractors, under their own direction, execute and document the pre-functional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment and systems.
g. The installing contractors, suppliers and manufacturers, develop specific equipment and system functional performance test procedures with the assistance of the CA.
h. The procedures are executed by the Subcontractors, under the direction of, and documented by the CA.
i. Items of non-compliance in material, installation or setup are corrected at the Subcontractor's expense and the system retested.
j. The CA reviews the Systems/O&M documentation for completeness. All Systems/O&M documentation must be submitted and approved before the start of training.
k. Commissioning shall be completed before Substantial Completion.
l. Deferred testing is conducted, as specified or required.

1.04 RESPONSIBILITIES

A. All Contractors, Subcontractors, and all other Commissioning team members will be required to coordinate and remedy all deficiencies in their area of responsibility defined in this section.

B. General Contractor (GC)
1. General Responsibilities
a. Facilitate the coordination of the commissioning work by the CA, and with the CA ensure that commissioning activities are being scheduled into the master schedule.
b. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.
c. In each purchase order or subcontract written, include requirements for submittal data, Systems/O&M data, commissioning tasks and training.
d. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
e. A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Commissioning process.
f. Prepare Systems/O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to record conditions.
2. Warranty Period
a. Ensure that Subcontractors execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
b. Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

C. Electrical Contractors and Sub-Contractors
1. The commissioning responsibilities applicable to each of the subcontractors are generally as follows (all references apply to commissioned equipment only). Specific requirements are shown in the appropriate Divisions.
2. Construction and Acceptance Phases
a. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, Systems/O&M data and training.
b. Attend a commissioning scoping meeting and other meetings necessary to facilitate the Commissioning process.

c. Contractors shall provide the CA with normal cut sheets and shop drawing submittals of commissioned equipment as part of the normal submittal process.
d. Provide additional requested documentation, prior to normal Systems/O&M manual submittals, to the CA for development of start-up and functional testing procedures.
e. Typically this will include detailed manufacturer 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, including all responsibilities of the Owner to keep the warranty in force clearly identified. 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 Commissioning Authority.
f. The Commissioning Authority may request further documentation necessary for the commissioning process.
g. Provide a copy of the Systems/O&M manuals and submittals of commissioned equipment, through normal channels, to the CA for review and approval.
h. Contractors shall assist (along with the design engineers) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
i. Prepare the specific functional performance test procedures for review by the CA. Subs shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests.
j. Address current A/E punch list items before functional testing
k. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. 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.
l. Perform functional performance testing under the direction of the CA for specified equipment. Assist the CA in interpreting the monitoring data, as necessary.
m. Correct deficiencies (differences between specified and observed performance) as interpreted by the CA, and A/E and retest the equipment.
n. Prepare Systems/O&M manuals according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
o. Prepare redline record drawings for all drawings and final record drawings for contractor-generated coordination drawings.
p. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.

3. Warranty Period
   a. Execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.
   b. Correct deficiencies and make necessary adjustments to Systems/O&M manuals and record drawings for applicable issues identified in any seasonal testing.

D. Equipment Suppliers
1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CA.
4. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
5. Review test procedures for equipment installed by factory representatives.

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E. Commissioning Authority (CA)
1. The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the general contractor and the A/E. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance-which systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, checkout and functionally test equipment and systems, except for specified testing equipment supplied and installed by the CA.
   a. Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.
   b. Coordinate the commissioning work and, with the GC, ensure that commissioning activities are being scheduled into the master schedule.
   c. Revise, as necessary, Commissioning Plan-Construction Phase.
   d. Plan and conduct a commissioning scoping meeting.
   e. Request and review additional information required to perform commissioning tasks, including Systems/O&M materials, contractor start-up and checkout procedures.
   f. Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.
   g. Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, along with A/E reviews.
   h. Perform site visits, as necessary, to observe component and system installations. Attend selected planning and job-site meetings to obtain information on construction progress. Review construction-meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.
   i. Approve systems start-up by reviewing start-up reports and by selected site observation.
   j. Review the functional performance test procedures for equipment and systems developed by the subcontractors and suppliers. This may include energy management control system trending, or manual functional testing.
   k. Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.
   l. Compile and maintain a commissioning record.
   m. Review and approve the preparation of the Systems/O&M manuals.
   n. Provide a final commissioning report.
2. Warranty Period
   a. Coordinate and supervise required seasonal or deferred testing and deficiency corrections.
   b. Return to the site at 10 months into the 12-month warranty period and review with facility staff the current building operation and the condition of outstanding issues. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the Systems/O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

1.05 SCHEDULING

A. The CA will work with the GC according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the CM and GC for scheduling commissioning activities. The GC will integrate all commissioning activities into the master schedule. All

parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

PRODUCTS

2.01 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications.

EXECUTION

3.01 MEETINGS

A. Scoping Meeting
   1. Within 60 days of commencement of construction or after all subcontractors have been selected, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the GC. Information gathered from this meeting will allow the CA to revise the Commissioning Plan to its “final” version, which will also be distributed to all parties.

B. Miscellaneous Meetings
   1. Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs.

3.02 REPORTING

A. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, progress reports, etc.

B. Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

C. A final summary report by the CA will be provided focusing on evaluating commissioning process issues and identifying areas where the process could be improved. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report.

3.03 SUBMITTALS

THE CA WILL PROVIDE APPROPRIATE CONTRACTORS WITH A SPECIFIC REQUEST FOR THE TYPE OF SUBMITTAL DOCUMENTATION THE CA REQUIRES TO FACILITATE THE COMMISSIONING WORK. THESE REQUESTS WILL FOLLOW THE NORMAL SUBMITTAL PROCESS AND PROTOCOL. AT MINIMUM, THE REQUEST WILL INCLUDE THE MANUFACTURER AND MODEL NUMBER, THE MANUFACTURER'S PRINTED INSTALLATION AND DETAILED START-UP PROCEDURES, FULL SEQUENCES OF OPERATION, O&M DATA, PERFORMANCE DATA, ANY PERFORMANCE TEST PROCEDURES, CONTROL DRAWINGS AND DETAILS OF OWNER CONTRACTED TESTS. IN ADDITION, THE INSTALLATION 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 COMMISSIONING AUTHORITY. ALL DOCUMENTATION REQUESTED BY THE CA WILL BE INCLUDED BY THE SUBS IN THEIR SYSTEMS/O&M MANUAL CONTRIBUTIONS.

A. The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

4.02 FUNCTIONAL TESTING

A. This sub-section applies to all commissioning functional testing for all divisions.

B. Objectives and Scope
   1. The objective of functional testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
   2. In general, each system should be operated through all modes of operation where there is a specified system response. Verifying each sequence in the sequences of operation is required.

C. Development of Test Procedures
   1. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Each Sub or vendor responsible to execute a test shall provide assistance to the CA in developing the procedures review (answering questions about equipment, operation, sequences, etc.). Prior to execution, the Sub(s) shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested.
   2. The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

D. Test Methods
   1. Functional testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results. The CA will determine which method is most appropriate for tests that do not have a method specified.

E. Coordination and Scheduling
   1. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the pre-functional checklists and startup of all equipment and systems. The CA will schedule functional tests through the GC and affected Subcontractors. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.
   2. In general, functional testing is conducted after pre-functional testing and startup has been satisfactorily completed. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

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4.03 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

A. Documentation
   1. The CA shall witness and document the results of all functional tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC for review and approval and to the Subs for review. The CA will include the filled out forms in the Commissioning Report.

B. Non-Conformance
   1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported on a standard non-compliance form.
   2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.
   3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
   4. As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.
      a. When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:
      b. The CA documents the deficiency and the Sub's response and intentions and they go on to another test or sequence
      c. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
      d. The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the GC and to the Subcontractor representative assumed to be responsible.
      e. Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.
      f. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved.
   5. Cost of Retesting.
      a. The cost for the Subcontractor to retest a verification or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.
   6. The Contractor shall respond in writing to the CA at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
   7. The CA retains the original non-conformance forms until the end of the project.

C. Failure Due to Manufacturer Defect
   1. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable. In such case, the Contractor shall provide the Owner with the following:
      a. Within one week of notification, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided within two weeks of the original notice.
      b. Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc.

and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

c. The Owner will determine whether a replacement of all identical units or a repair is acceptable.

d. Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original

e. equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

D. Approval

1. The CA notes each satisfactorily demonstrated function on the test form. The CA recommends acceptance of each test using a standard form. The Owner gives final approval on each test using the same form, providing a signed copy to the CA and the Contractor.

4.04 SYSTEMS/OPERATION AND MAINTENANCE (O&M) MANUALS

A. The following Systems/O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.

B. Each Division shall compile and prepare documentation for all equipment and systems covered in that Division and deliver this documentation to the GC for inclusion in the Systems/O&M manuals, according to this section, prior to the training of owner personnel. This documentation shall include a combination of specification section, approved submittals and manufacturer O&M data revised to cover the specific equipment in the project.

C. The CA shall receive a copy of the Systems/O&M manuals for review.

D. Field checkout sheets and logs should be provided to the CA for inclusion in the Commissioning Record Book.

E. Review and Approvals

1. Review of the commissioning related sections of the Systems/O&M manuals shall be made by the A/E and by the CA.

4.05 WRITTEN WORK PRODUCTS

A. Written work products of Contractors will consist of the start-up and initial checkout plan described and the filled out start-up, initial checkout and verification checklists, manufacturer's factory and field testing and inspection forms, contractor's inspection and functional testing forms, Systems/O&M Manuals, /training plans and training records. These work products will be supplied to the CA to be included in the final commissioning report.

END OF SECTION

SECTION 26 0917
PROTECTIVE RELAYS - SCHNEIDER ELECTRIC POWERLOGIC EASERGY P SERIES

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 26 0573.10 - Power System Studies - Schneider Electric.

B. Section 26 0913.83 - Condition Monitoring Services - Schneider Electric Square D EcoStruxure Asset Advisor.

1.02 ABBREVIATIONS AND ACRONYMS

A. In: Nominal current (amps).

B. Vn: Nominal voltage (volts).

1.03 REFERENCE STANDARDS

A. IEC 60068-2-1 - Environmental Testing – Part 2-1: Tests – Test A: Cold; 2025.

B. IEC 60068-2-2 - Environmental Testing – Part 2-2: Tests – Test B: Dry Heat; 2025.

C. IEC 60068-2-6 - Environmental Testing – Part 2-6: Tests – Test Fc: Vibration (Sinusoidal); 2007.

D. IEC 60068-2-14 - Environmental Testing – Part 2-14: Tests – Test N: Change of Temperature; 2023.

E. IEC 60068-2-27 - Environmental Testing – Part 2-27: Tests – Test Ea and Guidance: Shock; 2008.

F. IEC 60068-2-30 - Environmental Testing – Part 2-30: Tests – Test Db: Damp Heat, Cyclic (12 h + 12 h Cycle); 2025.

G. IEC 60068-2-52 - Environmental Testing – Part 2-52: Tests – Test Kb: Salt Mist, Cyclic (Sodium Chloride Solution); 2017.

H. IEC 60068-2-60 - Environmental Testing – Part 2-60: Tests – Test Ke: Flowing Mixed Gas Corrosion Test; 2015.

I. IEC 60068-2-78 - Environmental Testing – Part 2-78: Tests – Test Cab: Damp Heat, Steady State; 2025.

J. IEC 60255-1 - Measuring Relays and Protection Equipment – Part 1: Common Requirements; 2022 .

K. IEC 60255-21-1 - Electrical Relays – Part 21: Vibration, Shock, Bump and Seismic Tests on Measuring Relays and Protection Equipment – Section One: Vibration Tests (Sinusoidal); 1988.

L. IEC 60255-21-2 - Electrical Relays – Part 21: Vibration, Shock, Bump and Seismic Tests on Measuring Relays and Protection Equipment – Section Two: Shock and Bump Tests; 1988.

M. IEC 60255-21-3 - Electrical Relays – Part 21: Vibration, Shock, Bump and Seismic Tests on Measuring Relays and Protection Equipment – Section 3: Seismic Tests; 1993.

N. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

O. IEC 60721-3-3 - Classification of Environmental Conditions – Part 3-3: Classification of Groups of Environmental Parameters and Their Severities – Stationary Use at Weatherprotected Locations; 2019.

P. IEC 60870-5-101 - Telecontrol Equipment and Systems – Part 5-101: Transmission Protocols – Companion Standard for Basic Telecontrol Tasks; 2003, with Amendment (2015).

Q. IEC 60870-5-103 - Telecontrol Equipment and Systems – Part 5-103: Transmission Protocols – Companion Standard for the Informative Interface of Protection Equipment; 1997.

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R. IEC 61000-4-2 - Electromagnetic Compatibility (EMC) - Part 4-2: Testing and Measurement Techniques - Electrostatic Discharge Immunity Test; 2025.

S. IEC 61000-4-3 - Electromagnetic Compatibility (EMC) – Part 4-3: Testing and Measurement Techniques – Radiated, Radio-Frequency, Electromagnetic Field Immunity Test; 2020.

T. IEC 61000-4-4 - Electromagnetic Compatibility (EMC) - Part 4-4: Testing and Measurement Techniques – Electrical Fast Transient/Burst Immunity Test; 2012.

U. IEC 61000-4-5 - Electromagnetic Compatibility (EMC) - Part 4-5: Testing and Measurement Techniques - Surge Immunity Test; 2014, with Amendment (2017).

V. IEC 61000-4-6 - Electromagnetic Compatibility (EMC) – Part 4-6: Testing and Measurement Techniques – Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields; 2023.

W. IEC 61000-4-8 - Electromagnetic Compatibility (EMC) – Part 4-8: Testing and Measurement Techniques – Power Frequency Magnetic Field Immunity Test; 2009.

X. IEC 61000-4-9 - Electromagnetic Compatibility (EMC) – Part 4-9: Testing and Measurement Techniques – Impulse Magnetic Field Immunity Test; 2016.

Y. IEC 61000-4-10 - Electromagnetic Compatibility (EMC) – Part 4-10: Testing and Measurement Techniques – Damped Oscillatory Magnetic Field Immunity Test; 2016.

Z. IEC 61000-4-12 - Electromagnetic Compatibility (EMC) – Part 4-12: Testing and Measurement Techniques – Ring Wave Immunity Test; 2017.

AA. IEC 61000-4-16 - Electromagnetic Compatibility (EMC) – Part 4-16: Testing and Measurement Techniques – Test for Immunity to Conducted, Common Mode Disturbances in the Frequency Range 0 Hz to 150 Hz; 2015.

BB. IEC 61000-4-18 - Electromagnetic Compatibility (EMC) – Part 4-18: Testing and Measurement Techniques – Damped Oscillatory Wave Immunity Test; 2019.

CC. IEC 61850 (SET) - Communication Networks and Systems for Power Utility Automation; 2022.

DD. IEC 61869-10 - Instrument Transformers – Part 10: Additional Requirements for Low-Power Passive Current Transformers; 2017.

EE. IEC 61869-11 - Instrument Transformers – Part 11: Additional Requirements for Low-Power Passive Voltage Transformers; 2017.

FF. IEC 62351 (SET) - Power Systems Management and Associated Information Exchange – Data and Communications Security - All Parts; 2026.

GG. IEC 62443-4-1 - Security for Industrial Automation and Control Systems – Part 4-1: Secure Product Development Lifecycle Requirements; 2018.

HH. IEC 62443-4-2 - Security for Industrial Automation and Control Systems – Part 4-2: Technical Security Requirements for IACS Components; 2019 (Corrigendum 2022).

II. IEEE 1588 - IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems; 2019, with Amendment (2024).

JJ. IEEE C37.2 - IEEE Standard for Electrical Power System Device Function Numbers, Acronyms, and Contact Designations; 2022.

KK. IEEE C37.90 - IEEE Standard for Relays and Relay Systems Associated with Electric Power Apparatus; 2005 (Reaffirmed 2011).

LL. IEEE C37.90.1 - IEEE Standard for Relays, Relay Systems, and Control Devices Used for Protection and Control of Electric Power Apparatus--Surge Withstand Capability (SWC) and Electrical Fast Transient (EFT) Requirements and Tests; 2024.

MM. IEEE C37.90.2 - IEEE Standard for Relays, Relay Systems, and Control Devices Used for Protection and Control of Electric Power Apparatus--Radiated Electromagnetic Interference Withstand Capability Requirements and Tests; 2024.

NN. IEEE C37.90.3 - IEEE Standard Electrostatic Discharge Tests for Protective Relays; 2023.

OO. ISO 9001 - Quality Management Systems — Requirements; 2015.

PP. ISO 14001 - Environmental Management Systems — Requirements with Guidance for Use; 2015.

QQ. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Operational Readiness Report:
   1. Document test results, including assumptions, conditions, allowances, and corrections made.
   2. Provide listing of field modifications and adjustments made including settings/parameters not identified as factory defaults within equipment's operations and maintenance manual documentation.
   3. Include certification, signed by Contractor and manufacturer's representative, that equipment and associated system have been installed, configured, and tested in accordance with manufacturer's recommendations, conforms to requirements of Contract Documents, and is ready for operation.

C. Manufacturer's qualification statement.

D. Executed warranty.

E. Project Record Documents:
   1. Construction, installation, schematic, and wiring diagrams updated to as-installed and commissioned state.
   2. Configured settings/parameters for adjustable components updated to as-installed and commissioned state, noted if different from factory default.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Spare Parts: For each type and size of unit installed.
      a. Provide minimum spare parts recommended by manufacturer.
      b. Touch-up paint for finishes.
      c. Package and mark spare parts for long-term storage. Provide separate anti-static containers for printed circuit boards.
   3. Tools: Manufacturer-specific special tools required to install, remove, test, and maintain protective relay components.
      a. Equipment Configuration Software: PC-based or mobile device application; provide one of each different communication interface cable required to connect computer/device configuration and programming.

1.05 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70.
   2. Requirements of local authorities having jurisdiction.
   3. Applicable local codes.

B. Manufacturer Qualifications:
   1. Firm engaged in manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for minimum of 10 years.
   2. Certified in accordance with ISO 9001 with applicable quality assurance system regularly reviewed and audited by third-party registrar. Develop and control manufacturing, inspection, and testing procedures under guidelines of quality assurance system.
   3. Service, repair, and technical support services available 24 hours per day, 7 days per week from manufacturer or their representative.

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4. Certified in accordance with ISO 14001, with product environmental profiles (PEPs) for specified products.

C. Installer Qualifications: Firm with minimum 10 years of experience with equipment of similar type and scope.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prior to delivery to project site, verify suitable storage space is available to store materials in well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, and corrosive atmospheres.

B. Protect materials during delivery and storage and maintain within manufacturer's written storage requirements. At minimum, store indoors in clean, dry space with uniform temperature to prevent condensation and protect electronics from potential damage from electrical and magnetic energy.

C. Deliver materials to project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and equipment tag number or service name as identified in Contract Documents.

D. Inspect products and report concealed damage or violation of delivery, storage, and handling requirements to Engineer.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty for defects in material and workmanship for 10 years from date of shipment. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Schneider Electric; PowerLogic Easergy P series Protection Relays; www.se.com/#sle.

B. Eaton.

C. Seimens.

2.02 PROTECTIVE RELAYS - GENERAL REQUIREMENTS

A. Provide specific protection functions designed for application indicated.

B. Comply with the following:

1. Electromagnetic Compatibility (EMC):
   a. IEC 60255-1.
   b. IEC 61000-4-2, Class 4.
   c. IEEE C37.90.3, Class 4.
   d. IEC 61000-4-3, Level 3.
   e. IEEE C37.90.2.
   f. IEC 61000-4-8, Level 5.
   g. IEC 61000-4-9, Level 5.
   h. IEC 61000-4-10, Level 5.
   i. IEC 61000-4-6, Level 3.
   j. IEC 61000-4-18, Level 3.
   k. IEEE C37.90.1.
   l. IEC 61000-4-12.
   m. IEC 61000-4-16, Level 4.

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n. IEC 61000-4-4, Level 4.
o. IEC 61000-4-5, Level 4.

2. Mechanical Robustness:
   a. Vibrations: IEC 60068-2-6 and IEC 60255-21-1, Class 2.
   b. Shocks: IEC 60068-2-27 and IEC 60255-21-2, Class 2.
   c. Earthquakes: IEC 60255-21-3, Class 2.
3. Climatic Withstand:
   a. Cold Exposure: IEC 60068-2-1.
   b. Dry Heat Exposure: IEC 60068-2-2.
   c. Temperature Variation: IEC 60068-2-14.
   d. Damp Heat Exposure in Service: IEC 60068-2-30 and IEC 60068-2-78.
   e. Salt Mist: IEC 60068-2-52.
   f. Corrosive Gas:
      1) IEC 60068-2-60, test 2 and 4.
      2) IEC 60721-3-3, test 2 and 4.
   g. Ingress Protection Rating: IEC 60529, IP 54.
   h. Conformal coating protective treatment complying with:
      1) IEC 60068-2-52.
      2) IEC 60068-2-60.
      3) IEC 60721-3-3, 3C2.

C. Protective Relay Diagnostics:
   1. Provide self-test diagnostics facilities.
   2. Detect internal relay failures that may cause nuisance tripping or failed fault tripping.
      a. Set relay in fail-safe position leading to fallback position to avoid unwanted tripping if major internal fault is detected.
      b. Provide form C watchdog relay to provide alarm or information to activate back-up protection.
      c. Do not interrupt protection function operations due to minor failures, operate relay in downgraded mode.
      d. Consider absence or failure of remote module as minor failure.
      e. Consider absence or failure of logic input/output module as major failure.
   3. Inform for maintenance operation.
   4. Check hardware configuration.

D. Provide keypad to select operations including display of metering and operating data, alarm messages, clearing of alarms and resetting, acknowledgement, and access to protection and other relay settings.

E. Provide virtual 3-phase energy injection simulation, accessible via relay management software or remotely via web browser.

F. Provide Windows-based relay management software including:
   1. Metering and operating data, including alarm messages.
   2. Fault Recording: Single or multi-curve display, two pointers for differential measurement, zoom, pinch, and printing.
   3. Breaker diagnostic data.
   4. Protection and parameter settings.
   5. Logical status of inputs, outputs, and signal LEDs.

G. Condition Monitoring Service:
   1. See Section 26 0913.83 for additional information.
   2. Provide asset monitoring service to assess current operating condition of monitored equipment, assign health index for each asset, identify corrective actions needed, and provide reports to optimize management of electrical distribution system assets.

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2.03 PROTECTIVE RELAYS; POWERLOGIC EASERGY P5 SERIES

A. Basis of Design: Schneider Electric; PowerLogic Easergy P5 series; www.se.com/#sle.

B. Technology and Functionality:
   1. Base design on microprocessor technology. Accommodate hardware/software architecture consisting of multifunction and control platform with digital and analog inputs/outputs including protections, metering, control, monitoring, human machine interface (HMI) color LCD display, and multiple communication interfaces.
   2. Provide network, machine, switchgear, and relay diagnostic capabilities.

C. Programming and Configuration:
   1. Programmable and configurable with appropriate settings software using Microsoft Windows based operating system on standard personal computer.
   2. Program and configure locally from front panel via USB type B cable or remotely through communication network with adequate passwords to prevent unauthorized access.
   3. Provide minimum of seven programmable function keys and at least 10 freely programmable three-color LEDs.
   4. Provide settings software free of charge that does not require installation to use.
   5. Support configuration via built-in webserver when Ethernet port is available.
   6. Support configuration via mobile app.

D. Hardware and Software Architecture:
   1. Accommodate digital and isolated input/outputs. Use inputs to monitor status of MV/LV panel and receive external signals including Buchholz and inter-trip. Use outputs for circuit breaker or contactor control, inter-tripping between panels, and remote alarms.
   2. Support 1A/5A direct CT connections or LPCT connections.
   3. Operating Temperature Range: From minus 40 degrees F to 158 degrees F.
   4. Rate circuit breaker control output relay in accordance with IEEE C37.90.
   5. Provide CT/VT and trip circuit supervision facilities to check wiring circuit continuity with relevant alarms and messages.
   6. Component substitution due to component obsolescence not to affect upward compatibility between protective relays.
   7. Provide circuit boards with conformal coating.

E. Provide LCD mimic bus display for human machine interface (HMI) that indicates measurement values, operating messages, and device maintenance messages.
   1. Provide display with minimum four lines of clean annunciation of alarm conditions.

F. Support multi-languages on HMI and configuration tool.

G. Functions and displays of HMI to be remotely accessible via web browser and smart apps to support most advantageous location for operation and monitoring.

H. Inputs/Outputs:
   1. Support up to 40 digital inputs and 18 digital outputs.
   2. Provide minimum of one high-speed control digital output.
      a. Operation Time: Less than one millisecond.
      b. Carry Current Capability: 30 A for three seconds.
   3. Provide settable digital input voltage thresholds from 24 to 220 VDC or 220 VAC.
   4. Support four analog outputs and four analog outputs plus 12 RTDs inputs (or 12 temperature sensor inputs) as extension to protective relay for transformer and motor applications.
   5. Support direct connection of up to six arc flash point sensors. Apply arc flash trip logic based on light detection inputs only or combination of light and current detection to minimize nuisance trips.
   6. Support LPCT inputs and LPVT inputs complying with IEC 61869-10 and IEC 61869-11.

I. Support time synchronization based on IRIG-B module, communication network, or digital input as pulse clock synchronizing.

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J. Equipment Requirements:
1. Support flush mounting or rack mounting.
2. Provide IP54 front side ingress protection rating in accordance with IEC 60529.
3. Provide withdrawable design with external backup memory module for saving relay configuration settings in event replacement relay is required.

K. Protection Application Requirements:
1. Provide protective relay for each circuit breaker as indicated on drawings.
2. Provide protection types (IEEE C37.2 device function numbers) required for application (e.g., main, feeder, or motor).
3. Main/Feeder Protection Level Capabilities:
   a. Current Protection:
      1) Neutral admittance (21YN).
      2) Negative sequence overcurrent (46).
      3) Broken conductor (46BC).
      4) Phase overcurrent (50/51).
      5) Ground fault overcurrent (50/51N).
      6) Breaker failure (50BF).
      7) Sensitive earth fault (50G/51G).
      8) Switch on to fault (50HS).
      9) Low impedance restricted ground fault (64REF).
      10) Directional phase overcurrent (67).
      11) Directional ground fault, transient ground fault directional (67N/67NI).
      12) Cold load pickup (CLPU).
   b. Voltage Protection:
      1) Undervoltage (27).
      2) Negative sequence overvoltage (47).
      3) Overvoltage (59).
      4) Neutral voltage displacement (59N).
   c. Frequency Protection:
      1) Over/under frequency (81).
      2) Underfrequency (81U).
      3) Rate of change of frequency (81R).
   d. Thermal Protection:
      1) Temperature monitoring (38).
      2) Thermal overload (49).
   e. Power Protection:
      1) Wattmetric ground fault (32N).
      2) Directional active underpower (32P).
   f. Line Protection:
      1) Fault locator (21F).
      2) Auto-recloser (79).
   g. Transformer Protection:
      1) Inrush/2nd harmonic detection (68H2).
      2) Fifth harmonic detection (68H5).
   h. Capacitor Protection:
      1) Capacitor bank unbalance (51C).
      2) Capacitor overvoltage (59C).
   i. Other Protection:
      1) Arc-flash detection (50ARC).
      2) Programmable stages (99).
   j. Control, Monitoring, Supervision:
      1) Synchronization check (25).

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2) CT/VT supervision (60).
3) Lockout (86).

4. Motor Protection Level Capabilities:
   a. Current Protection:
      1) Neutral admittance (21YN).
      2) Phase undercurrent (37).
      3) Negative sequence overcurrent (46).
      4) Phase overcurrent (50/51).
      5) Ground fault overcurrent (50/51N).
      6) Breaker failure (50BF).
      7) Sensitive earth fault (50G/51G).
      8) Switch on to fault (50HS).
      9) Low impedance restricted ground fault (64REF).
      10) Directional phase overcurrent (67).
      11) Cold load pickup (CLPU).
   b. Voltage Protection:
      1) Undervoltage (27).
      2) Negative sequence overvoltage (47).
      3) Overvoltage (59).
      4) Neutral voltage displacement (59N).
   c. Frequency Protection:
      1) Over/under frequency (81).
      2) Underfrequency (81U).
   d. Thermal Protection:
      1) Temperature monitoring (38).
      2) Thermal overload (49).
   e. Power Protection:
      1) Wattmetric ground fault (32N).
      2) Directional active underpower (32P).
   f. Rotating Machine Protection:
      1) Overspeed (12).
      2) Underspeed (14).
      3) Positive sequence undervoltage (27P)
      4) Motor startup supervision, locked rotor (48/51LR).
      5) Frequency start inhibition (66).
      6) Anti-backspin (ABS).
   g. Transformer Protection:
      1) Inrush/2nd harmonic detection (68H2).
      2) Fifth harmonic detection (68H5).
   h. Other Protection:
      1) Arc-flash detection (50ARC).
      2) Programmable stages (99).
   i. Control, Monitoring, Supervision:
      1) CT/VT supervision (60).
      2) Lockout (86).

L. Protective Relay Metering Measurements:
   1. Provide accurate measurement processing functions and display metering data on HMI.
   2. Provide complete set of measurement functions, including 3-phase currents and voltages, zero-sequence/negative-sequence/positive sequence currents and voltages.
   3. Accuracy Within Plus/Minus Five Hz of Nominal Frequency:
      a. Current: 0.5 percent at greater than 0.05 times In.
      b. Voltage: 0.5 percent at greater than 50 percent of Vn.

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c. Frequency: 0.01 Hz.

4. Provide power factor, active power, reactive power, apparent power, active energy, and reactive energy.
5. Provide power quality information, including 2nd to 15th harmonic per phase current and voltage, total harmonic distortion, and voltage sag/swell.
6. Support minimum of 2,000 sequence-of-events associated time stamps with 1 millisecond accuracy stored in nonvolatile memory.
7. Support minimum of 200 fault recorders associated time stamps with 1 millisecond accuracy stored in nonvolatile memory.
8. Support disturbance recording at 48 samples per power cycle for 12 analogue channels and 80 binary inputs. Support minimum of 30 disturbance recordings, with 10-second length for each recording.

M. Protective Relay Communication:
1. Provide one USB port on front panel for configuration and data extraction.
2. Support download of disturbance record files to USB hard drive by triggering directly from front panel.
3. Support multiple communication port option modules capable of future addition or removal with possible configurations including one RS485 plus one Ethernet, one RS485 plus two Ethernet, and three Ethernet.
4. Relay protocols dependent upon medium of communication only; do not require additional ordering option for specific protocol.
5. Supported Open Communications Protocols:
a. Modbus RTU.
b. Modbus TCP/IP.
c. DNP3 (Serial and Ethernet).
d. IEC 61850 (SET), editions 1 and 2.
e. IEC 60870-5-101 and IEC 60870-5-103.
f. Ethernet/IP
6. Support RSTP and PRP/HSR redundancy protocols.
7. Support GOOSE communication in accordance with IEC 61850 (SET) with GOOSE timing performance for tripping applications less than 6 milliseconds; support analogue GOOSE.
8. Support up to eight simultaneous MMS clients complying with IEC 61850 (SET).
9. Support precise time protocol in accordance with IEEE 1588 for time synchronization.
10. Support concurrent multiple communication protocols.
11. In absence of setting software, support relay accessibility via embedded web browser and/or smart apps.

N. Cybersecurity:
1. Secure firmware upgrade with firmware signature to avoid unauthorized access.
2. Comply with IEC 62443-4-1, IEC 62443-4-2 Security Level 1 (SL1), IEC 62351 (SET), and NERC CIP requirements.
3. Support password management, communication port hardening, security logs, and central security management for role based access control (RBAC) using industry standard protocol.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine equipment exterior and interior for damage, including but not limited to, structure, moisture, and mildew.

B. Examine for conditions detrimental to completion of work.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer’s written instructions.

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3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Manufacturer Services: Provide services of manufacturer's field representative to perform functional testing, commissioning, and first parameter adjusting.
   1. Include necessary material, equipment, labor, and technical supervision.
   2. Replace damaged or malfunctioning equipment and report discrepancies or installation issues.
   3. Protection Settings:
      a. See Section 26 0573.10 for additional requirements.
      b. Configure protection settings in accordance with project power system study.
   4. Identify protective relays with label indicating inspection/testing agency and date of service.

C. Operational Readiness Testing:
   1. Inspect and test equipment and associated systems for conformance to Contract Documents, including equipment manufacturer’s recommendations, and readiness for operation.
      a. Visually inspect for physical damage and proper installation.
      b. Perform tests in accordance with manufacturer's instructions.
      c. Perform tests to verify compliance with Contract Documents.
      d. Perform tests to verify equipment is ready for operation.
      e. Touch-up paint chips and scratches with manufacturer-supplied paint.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7900 - Demonstration and Training for additional requirements.

B. Functional Demonstration Testing: Demonstrate proper operation of protective relays and associated systems to Owner's designated representative and Engineer, observing and documenting compliance with Contract Documents.

C. Training:
   1. Train Owner's personnel on operation and maintenance of system.
      a. Accommodate minimum of four attendees.
      b. Provide not less than one session(s) with four hours of classroom and hands-on training.
      c. Training Reference: Use submitted operations and maintenance manuals.
      d. Instructor: Factory-trained manufacturer's representative.
      e. Location: Project site.
   2. Provide sufficient time and detail in each session to cover the following at minimum:
      a. Operation theory.
      b. Major equipment components.
      c. Equipment operation.
      d. Equipment configurations.
      e. Maintenance, troubleshooting, and repair.
      f. Component-level parts replacement.

3.05 PROTECTION

A. Protect relays from subsequent construction operations.

END OF SECTION

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SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Outdoor motion sensors.

C. Time switches.

D. In-wall time switches.

E. Outdoor photo controls.

F. Daylighting controls.

G. Lighting contactors.

H. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems

B. Section 26 0533.16 - Boxes for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

1.03 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2023.

C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2020.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

G. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

H. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

K. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

L. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

M. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

N. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

O. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

P. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Samples:
1. Occupancy Sensors: One for each type and color specified.
2. In-Wall Time Switches: One for each type and color specified.
3. Daylighting Control Photo Sensors: One for each type and color specified.

E. Field Quality Control Reports.

F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Include detailed information on device programming and setup.

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 Locking Receptacle-Mounted Outdoor Photo Controls: Five percent of total quantity installed for each type, but not less than two of each type.
3. Electronic Trip Circuit Breakers: Provide one portable test set.
4. Indicating Lights: Two of each different type.

I. Project Record Documents: Record actual installed locations and settings for lighting control devices.

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1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

D. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.
   1. All wiring for lighting controls shall be in conduit. Refer to 26 05 33.13 for conduit applications.

2.02 OCCUPANCY SENSORS

A. Manufacturers:
   1. Acuity Brands, Inc; NLIGHT: www.acuitybrands.com/#sle.
   2. Hubbell Incorporated; NX: www.hubbell.com/#sle.
   3. Cooper
   4. Watt Stoppoer; DLM
   5. Other systems approved prior to bidding..
   6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
      b. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.

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4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
7. Sensitivity: Field adjustable.
8. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
9. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
10. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
11. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
12. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
13. Wireless Sensors:
    a. RF Range: 30 feet through typical construction materials.
    b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
    c. Power: Battery-operated with minimum ten-year battery life.

C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
    c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
    e. Finish: Color to be selected by architect.
2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Wall Dimmer Occupancy Sensors:
1. General Requirements:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
    b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
    d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.

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e. Provide fade-to-off operation to notify occupant of impending load turn-off.
f. Finish: Color to be selected by architect.

2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

E. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
a. Description: Low profile occupancy sensors designed for ceiling installation.
b. Provide field selectable setting for disabling LED motion detector visual indicator.
c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
d. Finish: White unless otherwise indicated.
2. Ultrasonic Ceiling Mounted Occupancy Sensors:
a. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.
3. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
a. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

F. Directional Occupancy Sensors:
1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
b. Provide field selectable setting for disabling LED motion detector visual indicator.
c. Finish: White unless otherwise indicated.
2. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.

G. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control the load indicated on drawings.

H. Power Packs for Wireless Occupancy Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
2. Input Supply Voltage: Dual rated for 120/277 V ac.
3. Load Rating: As required to control the load indicated on drawings.
4. Rated Life of Relay: One million cycles.

2.03 OUTDOOR MOTION SENSORS

A. Manufacturers:
1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
2. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.
3. Cooper
4. Watt Stopper; DLM
5. Other systems approved prior to bidding..
6. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

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B. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.

C. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.

D. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during an adjustable turn-off delay time interval.

E. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.

F. Integral Photocell: For dusk to dawn operation.

G. Manual Override: Activated by switching power off to unit and then back on.

H. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.

I. Coverage: Capable of detecting motion within a distance of 50 feet at a mounting height of 8 feet, with a field of view of 270 degrees.

2.04 TIME SWITCHES

A. Manufacturers:
1. Intermatic, Inc: www.intermatic.com/#sle.
2. NSI Industries LLC: www.nsiindustries.com/#sle.
3. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
   a. 24-Hour Time Switches: Single channel, with same schedule for each day of the week and skip-a-day feature to omit selected days.
   b. 7-Day Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days.
   c. Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Provide remote photocell input with light level adjustment.
8. Input Supply Voltage: As indicated on the drawings.
9. Output Switch Configuration: As required to control the load indicated on drawings.
10. Output Switch Contact Ratings: As required to control the load indicated on drawings.
11. Provide lockable enclosure; environmental type per NEMA EN 10250 as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 1.

2.05 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
1. Intermatic, Inc: www.intermatic.com/#sle.
2. NSI Industries LLC: www.nsiindustries.com/#sle.
3. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. Stem-Mounted Outdoor Photo Controls:
   1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
   2. Housing: Weatherproof, impact resistant polycarbonate.
   3. Photo Sensor: Cadmium sulfide.
   4. Provide external sliding shield for field adjustment of light level activation.
   5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
   6. Voltage: As required to control the load indicated on the drawings.
   7. Failure Mode: Fails to the on position.
   8. Load Rating: As required to control the load indicated on the drawings.

C. Locking Receptacle-Mounted Outdoor Photo Controls
   1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
   2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
   3. Photo Sensor: Cadmium sulfide.
   4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
   5. Voltage: As required to control the load indicated on the drawings.
   6. Failure Mode: Fails to the on position.
   7. Load Rating: As required to control the load indicated on the drawings.
   8. Surge Protection: 160 joule metal oxide varistor.

D. Button Type Outdoor Photo Controls
   1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
   2. Housing: Weather resistant polycarbonate.
   3. Photo Sensor: Cadmium sulfide.
   4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
   5. Voltage: As required to control the load indicated on the drawings.
   6. Failure Mode: Fails to the on position.
   7. Load Rating: As required to control the load indicated on the drawings.

2.06 DAYLIGHTING CONTROLS

A. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

B. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
   1. Sensor Type: Filtered silicon photo diode.
   2. Sensor Range:
      a. Indoor Photo Sensors: 5 to 100 footcandles.
   3. Finish: White unless otherwise indicated.
   4. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
   5. Wireless Daylighting Control Photo Sensors:
      a. RF Range: 30 feet through typical construction materials.
      b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
      c. Power: Battery-operated with minimum ten-year battery life.

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C. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
   2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
   3. Control Capability:
      a. Single Zone Switching Modules: Capable of controlling one programmable channel.

D. Daylighting Control Switching Modules for Wireless Sensors:
   1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected settings.
   2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
   3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
   4. Control Capability: Capable of controlling one programmable channel.
   5. Input Supply Voltage: Dual rated for 120/277 V ac.
   6. Load Rating: As required to control the load indicated on drawings.
   7. Rated Life of Relay: One million cycles.

E. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
   2. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
   3. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
   4. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.

F. Daylighting Control Dimming Modules for Wireless Sensors:
   1. Description: Plenum rated control unit compatible with specified wireless photo sensors and with specified dimming ballasts, for continuous dimming of compatible dimming ballasts in response to changes in measured light levels according to selected settings.
   2. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
   3. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
   4. Control Capability: Capable of controlling up to 32 ballasts with up to two separately programmable daylighting zones.

G. Power Packs for Low Voltage Daylighting Control Modules:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   2. Input Supply Voltage: Dual rated for 120/277 V ac.
   3. Load Ratings: As required to control the load indicated on drawings.

2.07 LIGHTING CONTACTORS

A. Manufacturers:
   1. ABB: www.electrification.us.abb.com/#sle.
   2. Eaton Corporation: www.eaton.com/#sle.
   3. Schneider Electric: www.se.com/#sle.
   4. Siemens Industry, Inc; _____: www.new.siemens.com/#sle.

B. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.

C. Short Circuit Current Rating:
   1. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Enclosures:
   1. Comply with NEMA IA 10030.
   2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1 or Type 12.
      b. Outdoor Locations: Type 3R or Type 4.
   3. Finish: Manufacturer's standard unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 42 inches above finished floor.
      b. In-Wall Time Switches: 42 inches above finished floor.
      c. In-Wall Interval Timers: 42 inches above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

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3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.

G. Provide required supports in accordance with Section 26 0529.

H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

I. Identify lighting control devices in accordance with Section 26 0553.

J. Occupancy Sensor Locations:
1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

K. Outdoor Photo Control Locations:
1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

L. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

M. Daylighting Control Photo Sensor Locations:
1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

N. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

O. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

P. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 0533.16 for mounting of lighting control device system components.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Section 01 9113 - General Commissioning Requirements for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
   4. Location: At project site.

END OF SECTION

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SECTION 26 2200
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

B. K-factor transformers rated for nonlinear loads.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems: Flexible conduit connections.

E. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 2416 - Panelboards.

H. Section 26 2713 - Electricity Metering: Instrument transformers for electrical metering.

1.03 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers; 2015.

C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers; 2013.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.

F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

G. NEMA ST 20 - Dry Type Transformers for General Applications; 2021.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

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1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
   1. Vibration Isolators: Include attachment method and rated load and deflection.
   2. K-factor Rated Transformers: Include K-factor ratings.

C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Maintenance Data: Include recommended maintenance procedures and intervals.

H. Project Record Documents: Record actual locations of transformers.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
   1. Greater than 10 kVA: 104 degrees F maximum.
   2. Less than 10 kVA: 77 degrees F maximum.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

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E. Source Limitations: Provide transformers produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F.
      b. Less than 10 kVA: Not exceeding 77 degrees F.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Insulation System and Allowable Average Winding Temperature Rise:
   1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
   2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

C. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.

D. Winding Taps:
   1. Less than 3 kVA: None.
   2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
   3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
   4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

E. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

F. Sound Levels: Standard sound levels complying with NEMA ST 20

G. Mounting Provisions:
   1. Less than 15 kVA: Suitable for wall mounting.
   2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
   3. Larger than 75 kVA: Suitable for floor mounting.

H. Transformer Enclosure: Comply with NEMA ST 20.

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1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 2.
   b. Outdoor locations: Type 3R.
2. Construction: Steel.
   a. Less than 15 kVA: Totally enclosed, non-ventilated.
   b. 15 kVA and Larger: Ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

I. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.04 K-FACTOR TRANSFORMERS RATED FOR NONLINEAR LOADS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 1561, and designed to supply nonlinear loads to the degree designated by the UL defined K-factor; ratings as indicated on the drawings.

B. K-factor Rating: K-13, or higher.

C. Insulation System and Allowable Average Winding Temperature Rise: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

D. Coil Conductors: Continuous aluminum windings with terminations brazed or welded. Individually insulate secondary conductors and arrange to minimize hysteresis and eddy current losses at harmonic frequencies. Size secondary neutral conductor at twice the secondary phase conductor ampacity.

E. Winding Taps: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.

F. Neutral Bus: Sized to accommodate twice the rated secondary current.

G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

H. Sound Levels: Standard sound levels complying with NEMA ST 20

I. Mounting Provisions:
1. Up to 75 kVA: Suitable for wall, floor, or trapeze mounting.
2. Larger than 75 kVA: Suitable for floor mounting.

J. Electrostatic Shield: Provide grounded copper electrostatic shield between primary and secondary windings to attenuate electrical noise.

K. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 2.
   b. Outdoor locations: Type 3R.
2. Construction: Steel, ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

L. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

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B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 26 0533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Install transformers plumb and level.

G. Transformer Support:
   1. Provide required support and attachment in accordance with Section 26 0529, where not furnished by transformer manufacturer.
   2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
   3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
   4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

K. Identify transformers in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.

3.04 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 2726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.
B. Wall dimmers.
C. Receptacles.
D. Wall plates and covers.
E. Floor box service fittings.
F. Poke-through assemblies.
G. Access floor boxes.

1.02 RELATED REQUIREMENTS

A. Section 26 0533.16 - Boxes for Electrical Systems.
B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
C. Section 27 1000 - Structured Cabling: Voice and data jacks.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).
B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).
C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).
F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.
G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.
L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.

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6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Samples: One for each type and color of device and wall plate specified.

D. Field Quality Control Test Reports.

E. Operation and Maintenance Data:
1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.
3. Surge Protection Receptacles: Include information on status indicators.

F. Project Record Documents: Record actual installed locations of wiring devices.

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. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
3. Extra Keys for Locking Switches: Two of each type.
4. Extra Surge Protection Receptacles: Two of each type.
5. Extra Wall Plates: One of each style, size, and finish.
6. Extra Flush Floor Service Fittings: Two of each type.
7. Extra Poke-Through Core Hole Closure Plugs: Two for each core size.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles installed in kitchens.

F. Provide GFCI protection for receptacles serving electric drinking fountains.

G. Provide isolated ground receptacles for receptacles serving computers and electronic cash registers.

H. Unless noted otherwise, do not use combination switch/receptacle devices.

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I. For flush floor service fittings, use tile rings for installations in tile floors.

J. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: Color to be selected by architect with stainless steel wall plate.

C. Wiring Devices Connected to Emergency Power: Red with stainless steel wall plate factory engraved "Emergency".

D. Flush Floor Box Service Fittings: Color to be selected by architect wiring devices with aluminum cover and ring/flange.

E. Flush Poke-Through Service Fittings: Color to be selected by architect wiring devices with aluminum cover and aluminum flange.

F. Access Floor Boxes: Gray wiring devices with gray steel cover with insert to match floor covering.

2.03 WALL SWITCHES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 RECEPTACLES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Automatically Controlled Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.

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3. Isolated Ground Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
4. Tamper Resistant Convenience Receptacles: Commercial and Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
5. Tamper Resistant and Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type "A" and type "C") USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

2.05 WALL PLATES AND COVERS

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell-wiring.com/#sle.
2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.
3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
4. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

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E. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.06 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Thomas & Betts Corporation: www.tnb.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Description: Service fittings compatible with floor boxes provided under Section 26 0533.16 with components, adapters, and trims required for complete installation.

C. Flush Floor Service Fittings:
   1. Dual Service Flush Combination Outlets:
      a. Cover: Rectangular.
      b. Configuration:
         1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
         2) Voice and Data Jacks: As specified in Section 27 1000.
   2. Accessories:
      a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
      b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.07 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Thomas & Betts Corporation: www.tnb.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Flush Floor Service Fittings:
   1. Dual Service Flush Combination Outlets:
      a. Cover: Hinged door(s).
      b. Configuration:
         1) Power: One standard convenience duplex receptacle(s).
         2) Voice and Data Jacks: As specified in Section 27 1000.
   2. Accessories:
      a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

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F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that openings in access floor are in proper locations.

I. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 42 inches above finished floor.
      b. Wall Dimmers: 42 inches above finished floor.
      c. Receptacles: 18 inches above finished floor or 6 inches above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

I. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or

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improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

O. Identify wiring devices in accordance with Section 26 0553.

P. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

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SECTION 26 2813
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.02 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
   1. Spare Fuse Cabinet: Include dimensions.

C. 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 Fuses: One set(s) of three for each type and size installed.
   3. Fuse Pullers: One set(s) compatible with each type and size installed.
   4. Spare Fuse Cabinet Keys: Two.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Littelfuse, Inc: www.littelfuse.com/#sle.

C. Mersen: ep-us.mersen.com/#sle.

2.02 APPLICATIONS

A. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

B. Primary Protection for Control Transformers: Class CC, time-delay.

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2.03 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class CC Fuses: Comply with UL 248-4.

H. Provide the following accessories where indicated or where required to complete installation:
   1. Fuseholders: Compatible with indicated fuses.

2.04 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 26 0553.

END OF SECTION

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SECTION 26 2816.13
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

I. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

J. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

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C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of enclosed circuit breakers and adjacent equipment with all required clearances indicated.
   2. Include wiring diagrams showing all factory and field connections.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Source Limitations: Provide enclosed circuit breakers and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:

1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.

E. Conductor Terminations: Suitable for use with the conductors to be installed.

F. Provide thermal magnetic circuit breakers unless otherwise indicated.

G. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

H. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

I. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
   3. Provide surface-mounted enclosures unless otherwise indicated.

J. Provide externally operable handle with means for locking in the OFF position.

K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:
   1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
      b. 14,000 rms symmetrical amperes at 480 VAC.
   2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Provide mechanical lugs unless otherwise indicated.
   2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   1. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   1. Provide the following field-adjustable trip response settings:
      a. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      b. Instantaneous pickup.
      c. Ground fault pickup and delay where ground fault protection is indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

G. Provide the following circuit breaker types where indicated:
   1. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   2. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   3. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

H. Provide the following features and accessories where indicated or where required to complete installation:
   1. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed circuit breakers plumb.

F. Install flush-mounted enclosed circuit breakers so that trims fit completely flush to wall with no gaps and rough opening completely covered.

G. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 0573.

J. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

K. Identify enclosed circuit breakers in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
   1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

E. Test GFCI circuit breakers to verify proper operation.

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F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 2816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 0573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

E. Section 26 2813 - Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

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1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Project Record Documents: Record actual locations of enclosed switches.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

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E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
   2. Minimum Ratings:
      a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
      b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
      c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
   1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.
   2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
   1. Comply with NEMA BS 31047.
   2. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

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C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 4300
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

C. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 2413 - Switchboards.

C. Section 26 2416 - Panelboards.

1.03 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
   1. SPDs with EMI/RFI filter: Include noise attenuation performance.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
   1. UL 1449.
   2. UL 1283 (for Type 2 SPDs).

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

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G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual connections and locations of surge protective devices.

1.07 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Field-Installed, Externally Mounted Surge Protective Devices:
1. ABB: www.electrification.us.abb.com/#sle.
2. Intermatic, Inc: www.intermatic.com/#sle.
3. Schneider Electric: www.se.com/#sle.

B. Factory-installed, Internally Mounted Surge Protective Devices:
1. Same as manufacturer of equipment containing surge protective device, to provide complete listed assembly including SPD.

C. Source Limitations: Provide surge protective devices produced by single manufacturer and obtained from single supplier.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:
1. Wye Systems: L-N, L-G, N-G, L-L.
2. Single Split Phase Systems: L-N, L-G, N-G, L-L.

3. High Leg Delta Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):
1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
2. 240/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
3. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
1. Indoor clean, dry locations: Type 1.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
1. Switchboards: See Section 26 2413.
2. Panelboards: See Section 26 2416.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device - Basis of Design: Surge Suppression, LLC (SSI); Advantage Series; Model SSLB (100 kA/phase, Type 2, I-n = 20 kA); www.surgesuppression.com/#sle.
1. Voltage: As indicated on drawings.
2. Features: Discrete "all-mode" protection (10 modes for 3-phase wye circuits); component-level thermal fusing; internal circuit board-mounted overcurrent fusing; 200 kAIC SCCR; 25 year warranty.
3. Include the following options:
a. AC11 - Advanced internal audible alarm with on, off, and test with dry relay contacts.
b. (Only one of the following may be selected)
c. D1 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
d. P - Flush mount plate.

B. Surge Protective Device - Basis of Design: Surge Suppression, LLC (SSI); SpecPRO Series; Model SSMA8 (80 kA/phase, Type 2, I-n = 10 kA); www.surgesuppression.com/#sle.
1. Voltage: As indicated on drawings.
2. Features: Seven modes of protection; component-level thermal fusing; internal circuit board-mounted overcurrent fusing; 200 kAIC SCCR; 15 year warranty.
3. Include the following options:
a. AC11 - Advanced internal audible alarm with on, off, and test with dry relay contacts.
b. D1 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
c. P - Flush mount plate.

2.04 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Distribution locations include SPDs connected to distribution panelboards, motor control centers, and busway.

B. Surge Protective Device - Basis of Design: Surge Suppression, LLC (SSI); Advantage Series; Model SSLA (100 kA/phase, Type 2, I-n = 10 kA); www.surgesuppression.com/#sle.
   1. Voltage: As indicated on drawings.
   2. Features: Discrete "all-mode" protection (10 modes for 3-phase wye circuits); component-level thermal fusing; internal circuit board-mounted overcurrent fusing; 200 kAIC SCCR; 25 year warranty.
   3. Include the following options:
      a. AC11 - Advanced internal audible alarm with on, off, and test with dry relay contacts.
      b. D1 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
      c. P - Flush mount plate.

C. Surge Protective Device - Basis of Design: Surge Suppression, LLC (SSI); SpecPRO Series; Model SSMA8 (80 kA/phase, Type 2, I-n = 10 kA); www.surgesuppression.com/#sle.
   1. Voltage: As indicated on drawings.
   2. Features: Seven modes of protection; component-level thermal fusing; internal circuit board-mounted overcurrent fusing; 200 kAIC SCCR; 15 year warranty.
   3. Include the following options:
      a. AC11 - Advanced internal audible alarm with on, off, and test with dry relay contacts.
      b. D1 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
      c. P - Flush mount plate.

2.05 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device - Basis of Design: Surge Suppression, LLC (SSI); Advantage Series; Model SSLA (100 kA/phase, Type 2, I-n = 10 kA); www.surgesuppression.com/#sle.
   1. Voltage: As indicated on drawings.
   2. Features: Discrete "all-mode" protection (10 modes for 3-phase wye circuits); component-level thermal fusing; internal circuit board-mounted overcurrent fusing; 200 kAIC SCCR; 25 year warranty.
   3. Include the following options:
      a. AC11 - Advanced internal audible alarm with on, off, and test with dry relay contacts.
      b. D1 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
      c. P - Flush mount plate.

B. Surge Protective Device - Basis of Design: Surge Suppression, LLC (SSI); SpecPRO Series; Model SSMA8 (80 kA/phase, Type 2, I-n = 10 kA); www.surgesuppression.com/#sle.
   1. Voltage: As indicated on drawings.
   2. Features: Seven modes of protection; component-level thermal fusing; internal circuit board-mounted overcurrent fusing; 200 kAIC SCCR; 15 year warranty.
   3. Include the following options:
      a. AC11 - Advanced internal audible alarm with on, off, and test with dry relay contacts.
      b. D1 - NEMA 1, 2, 3, 3S, 4X, and 12 composite enclosure with integral non-fused disconnect switch, with external handle
      c. P - Flush mount plate.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

D. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

E. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

F. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.04 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 5100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0533.16 - Boxes for Electrical Systems.

C. Section 26 0923 - Lighting Control Devices.

D. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

1.03 REFERENCE STANDARDS

A. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

B. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

C. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

I. UL 1598 - Luminaires; Current Edition, Including All Revisions.

J. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

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1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
   3. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

F. 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 Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
   3. Extra Lamps: Ten percent of total quantity installed for each type, but not less than two of each type.

G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

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1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 3-year manufacturer warranty for LED replacement lamps.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single- or double-face as indicated or as required for installed location.
   2. Directional Arrows: As indicated or as required for installed location.

2.04 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
      a. Wall Dimmers: See Section 26 2726.
      b. Daylighting Controls: See Section 26 0923.

2.05 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

D. Fire-Rated Luminaire Enclosures:
   1. Provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
   7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Suspended Luminaires:
   1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

2. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
3. Install canopies tight to mounting surface.
4. Unless otherwise indicated, support pendants from swivel hangers.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

L. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7900 - Demonstration and Training, for additional requirements.

B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.09 ATTACHMENTS

A. Luminaire schedule.

END OF SECTION

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SECTION 26 5600
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Poles and accessories.

C. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 2813 - Fuses.

1.03 REFERENCE STANDARDS

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; 2013, with Editorial Revision (2025).

B. ANSI O5.1 - American National Standard for Wood Poles: Specifications and Dimensions; 2022.

C. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

D. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

E. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

F. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

H. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

I. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012 (Reaffirmed 2018).

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 1598 - Luminaires; Current Edition, Including All Revisions.

L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

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1. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
   3. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

E. Field Quality Control Reports.
   1. Include test report indicating measured illumination levels.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

G. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

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. Touch-Up Paint: 2 gallons, to match color of pole finish.

I. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

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B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. LED Luminaires:
   1. Components: UL 8750 recognized or listed as applicable.
   2. Tested in accordance with IES LM-79 and IES LM-80.
   3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 POLES

A. Manufacturers:
   1. Acuity Brands, Inc: www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc: www.hubbelllighting.com/#sle.

B. All Poles:
   1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
   2. Structural Design Criteria:
      a. Comply with AASHTO LTS.
      b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
      c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
      d. Include structural calculations demonstrating compliance with submittals.
   3. Material: Steel, unless otherwise indicated.
   4. Shape: Square straight, unless otherwise indicated.
   5. Finish: Match luminaire finish, unless otherwise indicated.
   6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
   7. Unless otherwise indicated, provide with the following features/accessories:
      a. Top cap.
      b. Anchor bolts with leveling nuts or leveling shims.
      c. Provision for pole-mounted weatherproof GFI receptacle where indicated.

2.04 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

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B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires in accordance with NECA/IESNA 501.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Recessed Luminaires:
1. Install trims tight to mounting surface with no visible light leakage.

G. Suspended Luminaires:
1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
2. Install canopies tight to mounting surface.

H. Pole-Mounted Luminaires:
1. Maintain the following minimum clearances:
   a. Comply with IEEE C2.
   b. Comply with utility company requirements.
2. Foundation-Mounted Poles:
   a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
      1) Install anchor bolts plumb per template furnished by pole manufacturer.
      2) Position conduits to enter pole shaft.
   b. Install foundations plumb.
   c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
   d. Tighten anchor bolt nuts to manufacturer's recommended torque.
   e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
3. Embedded Poles: Install poles plumb as indicated.
4. Grounding:
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.

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5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
6. Install non-breakaway in-line fuse holders and fuses complying with Section 26 2813 in pole handhole or transformer base for each ungrounded conductor.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

E. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7900 - Demonstration and Training, for additional requirements.

B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.09 ATTACHMENTS

A. Luminaire schedule.

END OF SECTION

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SECTION 28 4600
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

D. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

A. Section 08 3323 - Overhead Coiling Doors: Coiling fire doors to be released by fire alarm system.

B. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

C. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

D. Section 21 2200 - Clean-Agent Fire-Extinguishing System: Supervisory, alarm, and releasing devices installed in extinguishing system.

E. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 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. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Proposal Documents: Submit the following with cost/time proposal:
   1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
   3. Certification by Contractor that the system design will comply with Contract Documents.
   4. Proposed maintenance contract.

C. Evidence of designer qualifications.

D. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.

3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
4. System zone boundaries and interfaces to fire safety systems.
5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
7. List of all devices on each signaling line circuit, with spare capacity indicated.
8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
10. Detailed drawing of graphic annunciator(s).
11. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
12. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
13. Certification by Contractor that the system design complies with Contract Documents.
14. Do not show existing components to be removed.

E. Evidence of installer qualifications.

F. Evidence of instructor qualifications; training lesson plan outline.

G. Evidence of maintenance contractor qualifications, if different from installer.

H. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

I. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

J. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

K. Closeout Documents:

1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.
4. Maintenance contract.
5. Report on training results.

L. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
4. Certified in the State in which the Project is located as fire alarm installer.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.06 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:
1. Honeywell Security & Fire Solutions/Gamewell-FCI; _____: www.gamewell-fci.com/#sle.
2. Other systems approved prior to bidding..
3. Provide control units made by the same manufacturer.

B. Initiating Devices and Notification Appliances:
1. Same manufacturer as control units.
2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. ADA Standards.
   b. The requirements of the State Fire Marshal.
   c. The requirements of the local authority having jurisdiction .
   d. Applicable local codes.
   e. Contract Documents (drawings and specifications).
   f. NFPA 101.
   g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
7. Program notification zones and voice messages as directed by Owner.
8. Fire Alarm Control Unit: New, located at supervising station.
9. Two-Way Telephone: Provide two-way telephone service for the use of the fire service and others; provide jacks and two portable handsets.
10. Combined Systems: Do not combine fire alarm system with other non-fire systems.

B. Supervising Stations and Fire Department Connections:
   1. Public Fire Department Notification: By on-premises supervising station.
   2. On-Premises Supervising Station: New proprietary station operated by Owner, located at _____.
   3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
   4. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

C. Circuits:
   1. Initiating Device Circuits (IDC): Class B, Style A.
   2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
   3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:
   1. Initiating Device Circuits: Minimum 25 percent spare capacity.
   2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
   3. Speaker Amplifiers: Minimum 25 percent spare capacity.
   4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
   4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing system completely after new system is fully operational and tested.

B. Clearly label components that are "Not In Service."

C. Remove unused existing components and materials from site and dispose of properly.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler water control valves.
   2. Dry-pipe sprinkler system pressure.
   3. Dry-pipe sprinkler valve room low temperature.
   4. Fire pump(s).
   5. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Sprinkler water flow.
   2. Total flooding suppression system activation.
   3. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
   4. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
   5. Duct smoke detectors.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
   2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
   3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

E. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
   2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.
   3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 3323.

2.05 COMPONENTS

A. General:
   1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. In addition to code required components, provide carbon monoxide detectors in all classrooms.

D. Provide wire guards for devices installed in gyms.

E. Master Control Unit: FACP.

F. Remote Annunciators: FAP.

G. Addressable Modules:
1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.
4. Control Modules: Provide as indicated or as required for selective control of notification appliances.
5. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.

H. Initiating Devices:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

I. Notification Appliances:
1. Bells: _____.
a. Provide 1 extra.
2. Speakers: _____.
a. Provide 1 extra.
3. Strobes: _____.
a. Provide 1 extra.

J. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

K. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.

L. Locks and Keys: Deliver keys to Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type

M. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

N. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
1. Padlock eye and hasp for lock furnished by Owner.
2. Locate as directed by Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
   1. All wiring for fire alarm system shall be in conduit. Refer to 26 05 33.13 for conduit applications and 26 05 53 for identification of emergency conduit for electrical systems.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
   3. Factory Instruction: At control unit manufacturer's training facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

D. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

E. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
   1. Initial Training: One 3-day session, pre-closeout.

F. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

G. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

3.04 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Specified diagnostic period without malfunction has been completed.
   2. Approved operating and maintenance data has been delivered.
   3. Spare parts, extra materials, and tools have been delivered.
   4. All aspects of operation have been demonstrated to Owner.
   5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   6. Occupancy permit has been granted.
   7. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.05 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and

parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

G. Comply with Owner's requirements for access to facility and security.

END OF SECTION

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SECTION 270010
GENERAL REQUIREMENTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. This Division and the associated Drawings, Addenda (when issued), and Contract Documents, identifies the requirements, technical design, and specifications for Communications Systems at the Turner Elementary School Classroom Additions located in Willis ISD.

B. Functionally complete Communications Systems shall be provided in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result shall be provided whether or not specifically called for, at no additional cost to Owner.

C. The Communications Systems include the following:
   1. Structured Cabling System
   2. Audio-Video Systems
   3. Paging System
   4. Clock System.
   5. Access Control
   6. Intrusion Detection
   7. Video Surveillance
   8. And the associated pathways for the systems listed above.

1.02 RELATED SECTIONS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27, and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents and shall coordinate them with the work on the project.

B. Refer to Division 26 for Electrical System requirements.

C. Refer to Division 28 for Electronic Security requirements.

1.03 CONFIDENTIALITY

A. Limit access to physical and electronic versions of these Division 27 specifications and associated Drawings to individuals directly involved in performing the Work.

B. At the conclusion of the Project, cross-shred any physical (paper) copies of both drawings and specifications before disposal.

1.04 ABBREVIATIONS

A. ADA – Americans with Disabilities Act

B. AFF – above finished floor

C. AHJ – authority having jurisdiction

D. ANSI – American National Standards Institute

E. AV – audiovisual

F. BOM – bill of materials

G. CAT – category

H. CATV – cable television

I. CD – Construction Document

J. DAS – distributed antenna system

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K. EMI – electromagnetic interference
L. EMT – electrical metallic tubing
M. ERRC – emergency responder radio coverage
N. FACP – fire alarm control panel
O. FCC – Federal Communications Commission
P. F/UTP – foiled, unshielded twisted pair
Q. GC – general contractor; Contractor
R. GMP – guaranteed maximum price
S. GUI – graphical user interface
T. HVAC – heating, ventilation, and air-conditioning
U. IBC – International Building Code
V. ICT – information and communications technology
W. IDF – intermediate distribution frame; a secondary Communications Room in a building
X. IMC – intermediate metal conduit
Y. ISO – International Organization for Standardization
Z. ISP – inside plant
AA. ISP – Internet service provider
BB. IT – information technology
CC. LAN – local area network
DD. MDF – main distribution room; the primary/main Communications Room for a building
EE. MPOE – minimum point of entry
FF. MTBF – mean time between failures
GG. NEC – National Electric Code
HH. NEMA – National Electrical Manufacturers Association
II. NFPA – National Fire Protection Association
JJ. NRTL – nationally recognized testing laboratory
KK. OEM – original equipment manufacturer
LL. OSP – outside plant
MM. PoE – power over Ethernet
NN. POS – point of sale
OO. POTS – plain old telephone service
PP. RF – radio frequency
QQ. RFI – request for interpretation/information
RR. RMC – rigid metal conduit
SS. RU – rack unit
TT. ScTP – screened twisted pair
UU. STP – shielded twisted pair
VV. TIA – Telecommunications Industry Association
WW. TR – telecommunications room
XX. U/FTP – unshielded twisted-pair cable with foil screened twisted-pair conductors

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YY. UL – Underwriters Laboratory

ZZ. UPS – uninterruptible power supply

AAA. USB – universal serial bus

BBB. UTP – unshielded twisted pair

CCC. VLAN – virtual LAN

DDD. VPN – virtual private network

EEE. WAN – wide area network

FFF. WAP – wireless access point

GGG. WLAN – wireless LAN

1.05 DEFINITIONS

A. Wherever used in the Division 27 specifications or associated drawings and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. If any of these terms are defined in the General Conditions in Division 1, those definitions shall take precedence.
   1. Addenda – written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
   2. Bid – the offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
   3. Bidder – the individual or entity who submits a Bid directly to Owner.
   4. Bidding Documents – the Bidding Requirements and the proposed Contract Documents (including all Addenda).
   5. Bidding Requirements – The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
   6. Change Order – A document recommended by Design Consultant which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
   7. Communication(s) Room – A generic term for a dedicated room for information technology equipment, frequently referred to as Telecommunications Room, Telecom Room, IDF, MDF, IT Room, or Equipment Room.
   8. Component Importance Factor – building components are assigned an importance factor in ASCE 07 Chapter 13; used in seismic structural analysis to determine seismic restraint requirements for building components.
   9. Contract – The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.
   10. Contract Documents – Those items so designated in the agreement between Owner and Contractor covering the Work.
      a. The Contract Documents are complementary; what is required by one is as binding as if required by all.
   11. Contractor – The individual or entity with whom Owner has entered into the Agreement.
   12. Design Consultant – the design firm responsible for creation of these Division 27 specifications and associated Drawings – COMBS Consulting Group LP.
   13. Drawings – The part of the Contract Documents prepared or approved by Design Consultant which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
   14. General Requirements – Sections of Division 1 of the Specifications.

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15. Laws and Regulations – Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
16. Notice to Proceed – a written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
17. Owner – the individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
18. Project – the total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
19. Samples – physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which established the standards by which such portion of the Work will be judged.
20. Seismic Design Category – a category from ASCE 07 assigned to a structure based on its occupancy category and the severity of the design earthquake ground motion at the Project Site.
21. Shop Drawings – all drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
22. Site – lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of the Contractor.
23. Specifications – the part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
24. Subcontractor – an individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
25. Substantial Completion – the time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of the Architect/Design Consultant, the Work is sufficiently complete, in accordance with the Contract Documents, so that the Work can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
26. Supplementary Conditions – the part of the Contract Documents which amends or supplements these General Conditions.
27. Supplier – A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
28. Underground Facilities – all underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
29. Work – the entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

B. Terminology
   1. The words and terms below are not defined, but when used in Division 27 specifications and related Drawings, have the indicated meaning:
      a. Intent of Certain Terms and Adjectives:

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1) The Contract Documents include the terms “as allowed,” “as approved,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Design Consultant. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Design Consultant as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Design Consultant any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the following provisions or any other provision of the Contract Documents.
    a) Limitations on Design Consultant’s Authority and Responsibilities
        i. Design Consultant will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Design Consultant will not be responsible for Contractor’s failure to perform the Work in accordance with the Contract Documents.

        ii. Design Consultant will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

b. Day – the word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
c. Defective – the word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
    1) Does not conform to the Contract Documents; or
    2) Does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
    3) Has been damaged prior to Substantial Completion.
d. Furnish – the word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
e. Install – the word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
f. Provide – the word “provide” and “perform,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
g. When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied, and those services, materials and equipment shall be furnished and installed.

C. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contractor Documents in accordance with such recognized meaning.

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D. Refer to individual sections for additional definitions.

1.06 REFERENCE STANDARDS

A. Standards, Specifications, Codes, Laws, and Regulations
   1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids, except as may be otherwise specifically stated in the Contract Documents.
   2. For referenced standards and guidelines that have not been adopted into code or law, the most recent version / edition of the standard and guideline shall be followed, except for the following:
      a. where the Contract Documents clearly establish size, quantity, and/or quality of services, materials, or equipment and/or the means, methods, techniques, sequences, or procedures of construction; in these instances, Contract Documents requirements shall take precedence.
   3. Whenever the Contract Documents details a requirement that violates an adopted code, law or regulation, submit RFI to Architect/Design Consultant prior to Bid or performing the Work.

B. Codes and Regulations
   1. The following codes, laws and regulations are known to have requirements that affect Communications Systems and are listed here for reference. Refer to Part 1 Coordination paragraph in this section for requirements when there are any discrepancies between these codes, laws and regulations and the Contract Documents.
      a. 2010 ADA Standards for Accessible Design
      b. ASCE 07 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures
      c. FCC Rules and Regulations
      d. National Electric Safety Code
      e. NFPA 70 – National Electric Code
      f. NFPA 72 – National Fire Alarm and Signaling Code
      g. NFPA 99 – Health Care Facilities Code
      h. NFPA 101 – Life Safety Code
      i. 2012 Texas Accessibility Standards
   2. Refer to individual sections for additional requirements.

C. Standards
   1. Refer to individual sections for additional requirements.

D. Guidelines
   1. Refer to individual sections for additional requirements.

1.07 QUALITY ASSURANCE

A. Contractor Qualifications
   1. Refer to individual sections for requirements.

B. Personnel Qualifications
   1. At all times during the progress of the Work, Contractor or Subcontractor shall assign a competent Project Manager who shall not be replaced without written notice to Owner and Design Consultant except under extraordinary circumstances.
   2. Refer to individual sections for additional requirements.

C. Network and Cybersecurity Requirements
   1. Network integrity is critical to Owner's operation of the Facility. Refer to Software, Network, and Cybersecurity Requirements paragraph in Part 3 of this Section.

1.08 WARRANTY

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A. Contractor's General Warranty and Guarantee
   1. If the General Requirements do not establish Contractor's General Warranty and Guarantee, then the following requirements are in effect for Communications Systems Work:
      a. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Design Consultant and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.
      b. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
         1) abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
         2) normal wear and tear under normal usage.
      c. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
         1) observations by Design Consultant;
         2) recommendation by the Architect/Design Consultant or payment by Owner of any progress or final payment;
         3) the issuance of a certificate of Substantial Completion by Architect/Design Consultant or any payment related thereto by Owner;
         4) use or occupancy of the Work or any part thereof by Owner;
         5) any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Design Consultant;
         6) any inspection, test, or approval by others; or
         7) any correction of defective Work by Owner.

B. Manufacturer Warranty
   1. Refer to individual sections for additional requirements.

C. Special Warranty
   1. Refer to individual sections for additional requirements.

1.09 SUBMITTALS

A. General Submittal Requirements:
   1. Refer to General Requirements (Division 1) for general submittal requirements. Refer to individual sections in Division 27 for additional requirements.
   2. Submittals and Shop Drawings shall not utilize the Design Consultant's logo, stamp, or the title block from the Construction Drawings; if either of these are submitted, the Submittal(s) will be rejected without review.
   3. Inadequate or Incomplete Submittals and/or Shop Drawings will not be reviewed and will be returned to the Contractor.

B. Pre-Bid
   1. Pre-Bid submittals can generally include:
      a. Clarifying questions.
      b. Product Substitution requests.
      c. Contractor and personnel qualification documentation.
   2. Refer to individual sections for specific Pre-Bid requirements.

C. Bid
   1. Refer to General Requirements for Bid Form and other requirements.

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2. Refer to individual sections for additional Division 27 requirements due with Bid, which may include – but is not limited to – the following:
   a. Contractor and personnel qualification documentation
   b. Unit Pricing
   c. Allowance(s)

D. Pre-Construction
   1. Procedures:
      a. Before submitting Pre-Construction submittals, Contractor shall have:
         1) reviewed and coordinated each Shop Drawing with other Shop Drawings and with the requirements of the Work and the Contract Documents;
         2) determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
         3) determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
         4) determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
      b. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
      c. With each submittal, Contractor shall give Design Consultant specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or submittal; and, in addition, by a specific notation made on each Shop Drawing submitted to Design Consultant for review and approval of each such variation.
      d. Design Consultant's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents.
      e. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Design Consultant.
      f. Contractor shall ensure submittals are submitted in a timely manner to ensure all products can be ordered and received on site in order to not cause any delays. If there are any concerns with any products having long lead times, those products shall be clearly identified in writing so the review and approval can be expedited.
      g. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e. product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will be returned unreviewed.
      h. Contractor shall submit the following Pre-Construction Submittals:
         1) 270533 Pathways for Communication
         2) 271000 Structured Cabling
         3) 274100 Audio Video
         4) <insert other Project specifications>
   2. Bill-of-Materials / Product Index
      a. Provide a typed listed with each product/equipment being provided as part each Section. List shall include the following, in the exact same order as listed in Division 27 specifications:
         1) Product/Equipment specification name
         2) Manufacturer
         3) Model name

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4) Model number

3. Product Data
   a. Provide product data sheet for each material, equipment, device, etc. listed in Part 2 of these specifications. Data sheet shall include manufacturer name, product name, part number and relevant product specifications in an 8.5”x11” PDF format.
   b. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted. Product data sheets without the part number clearly identified may not be approved.
   c. Submit concurrently with Shop Drawings
4. Shop Drawings
   a. Shop Drawings shall include the following:
      1) Contractor or Subcontractor’s titleblock; drawing size shall match Construction Drawings (ie 30” x 42”). Titleblock shall include:
         b) Project name and address
         c) Contractor/Subcontractor company name and contact information.
         d) Name and contact information of Contractor/Subcontractor’s Project Manager.
      2) Legend page with all symbols defined.
      3) Floors plans (minimum scale of 1/8” = 1’-0”) for all areas with Division 27 Work. Floor plans shall include north arrow, keyplan, and indicate device/equipment locations, and associated pathway routing and size.
      4) Enlarged plans (minimum scale of 1/4" = 1’-0”) and rack and wall elevations for Communications Rooms, Equipment Rooms, etc., indicating exact location where equipment is intended to be installed. Enlarged plans shall include north arrow.
      5) Riser diagrams, details, coordination views, etc. to indicate Contractor has a full understanding of required Work and is coordinated with other trades.
   b. Where installation location is critical – such as in Communications Rooms and Equipment Rooms, as well as outlet/device location height above finished floor – indicate figured dimension on Shop Drawings.
   c. Refer to individual sections for additional Shop Drawing requirements.
   d. Submit concurrently with Product data
5. Samples
   a. Refer to individual sections for requirements.
6. Certificates
   a. Refer to individual sections for requirements.
7. Delegated Design Submittals - the design for the following Division 27 systems has been deferred to the Contractor to complete as part of their Work:
   a. Structural analysis and required supports and connections for Communications Systems equipment and pathways over 200 pounds attached to overhead structure.
   b. Seismic analysis and seismic control measures for Communications Systems equipment and pathways.
   c. ERRC DAS

E. Refer to individual sections for additional Pre-Construction Submittal requirements.

1.10 PROJECT CLOSEOUT

A. Include **bolded items** in Preliminary Project Closeout Submittal (a minimum of two weeks before Final Site Observation) to facilitate Final Site Observation by Design Consultant.

B. Bill-of-Materials / Product Index – Update Bill-of-Materials that was included in the Pre-Construction Submittal with actual equipment installed. Include columns populated with the following information:
   1. Product Name (from Specifications)
   2. Manufacturer

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3. Model Number
4. Quantity installed on project
5. Manufacturer Warranty period (if longer than one year)

C. Product Data (Cutsheets)
1. Shall be in the same order as listed in the Specifications and Bill-of-Materials.

D. Operation and Maintenance Data
1. Shall be in the same order as listed in the Specifications and Bill-of-Materials.

E. Warranty Documentation
1. Include PDF copy of any Warranty documentation and/or certifications that came with the installed products or required by these Specifications.
2. Shall be in the same order as listed in the Specifications and Bill-of-Materials.

F. Test Results
1. Include PDF copy of Functional Test Reports for each section.
2. Refer to individual sections for testing requirements.

G. Spare Parts and Tools
1. At time of Owner Training, furnish any and all spare parts and tools to the Owner that are required by the Contract Documents.
2. In the Project Closeout Submittal, include PDF copy of delivery receipt, indicating items and quantities that were furnished to the Owner, as well as the date, time, and Owner Representative that took possession of the items.
3. Refer to individual sections for additional requirements.

H. Record Drawings (“As Builts”)
1. Maintain a copy of approved Submittals, Shop Drawings, and Change Orders on the Site (or the Project’s Construction Administration website), and update with changes during construction. Any minor changes to the Drawings shall be updated on a weekly basis. These drawings shall be made available for inspection at any point during construction when requested by the Architect / Design Consultant.
2. At the conclusion of the project, utilize AutoCAD or BIM software (such as Revit or Navisworks) to incorporate the changes to the Shop Drawings.
   a. PDF markups in software such as Bluebeam will not be acceptable.
3. Include both PDF and AutoCAD (2020 dwg file type) versions of every drawing in the Project Closeout Submittal.
4. Refer to individual sections for additional requirements.

I. Special Requirements – Refer to individual sections for additional requirements.

1.11 COORDINATION

A. Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to the Architect/Design Consultant any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from the Architect/Design Consultant before proceeding with any Work affected thereby.

B. If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation , (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to the Architect/Design Consultant in writing. Contractor shall not proceed with the Work affected thereby until an amendment or supplement to the Contract Documents has been issued.

C. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

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D. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

E. Refer to General Requirements / Division 1 for Schedule requirements. Subcontractors for Division 27 Work shall coordinate with Contractor in establishing schedules and timetables to perform the Work, and perform that Work per those established schedules.

F. The Contractor/Subcontractor for each Division 27 Section shall maintain a Project Manager (per the Quality Assurance paragraph of that Section) that is on the jobsite whenever Work for that Section is being performed. This Project Manager shall coordinate the Work with other trades, such that Division 27 Work is installed per the Schedule, with the required clearances for all Divisions of Work, and meets the required codes and standards.

G. Division 27 Work shall not impair, hinder, or delay Work of other trades.

H. Before starting Work, examine adjacent Work performed by other divisions (trades) to determine if there are any conditions that would be detrimental or prevent Division 27 Work from being a successful installation. Notify issues to Contractor for remediation prior to starting Work.

I. Unless otherwise indicated with a figured dimension, Drawings are schematic - indicating approximate location of devices and equipment. Communications devices and equipment may be figure-dimensioned on the Architectural Drawings, which take precedence over the approximate locations on the technology Drawings. Where neither Architectural or technology Drawings include a figured dimension, exact location shall be determined by scaled dimension and coordination with requirements of other trades. Errors that could have been avoided by proper coordination shall be corrected without additional costs to the Owner.

J. Coordination with other Divisions
   1. Division 21 Fire Suppression – ensure no piping is routed overhead through a Communications Room or Equipment Room, except where serving a fire suppression device in the Communications/Equipment Room.
   2. Division 22 Plumbing – ensure no piping is routed overhead through a Communications Room or Equipment Room.
   3. Division 23 Mechanical – ensure no piping or ductwork is routed overhead through a Communications Room or Equipment Room, except where serving Mechanical equipment in the Communications/Equipment Room.
   4. Division 26 Electrical
      a. Ensure no conduits are routed overhead through a Communications Room or Equipment Room, except where serving an Electrical panelboard or receptacles in the Communications/Equipment Room.
      b. Coordinate exact location of receptacles / hard-wired circuits for Division 27 equipment with Division 26 Contractor prior to rough-in installation.
      c. Prior to connecting Division 27 devices and equipment to an electrical receptacle, utilize a ground circuit impedance tester to detect any wiring errors and low equipment ground impedances. If any issues are detected, notify Division 26 Contractor for correction prior connecting Division 27 devices and equipment.
   5. Refer to individual sections for additional coordination requirements.

K. Preinstallation Meetings
   1. Refer to individual sections for additional requirements.

L. Sequencing / Scheduling
   1. Refer to individual sections for specific sequencing / scheduling requirements.

1.12 EXISTING CONDITIONS

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A. This Project is an expansion or renovation of an existing facility. Prior to Bid, visit site to ascertain existing conditions and to determine the extent of the Work in relation to the existing conditions.

B. Any Work associated with existing conditions that was reasonably observable prior to Bid (whether Contractor observed it or not) shall be performed without additional cost to Owner.
   1. In this context “reasonably observable” includes areas above accessible (“lay in”) ceiling; but does not include areas above inaccessible ceilings.

1.13 STRUCTURAL REQUIREMENTS

A. For equipment in excess of 200 pounds that is attached to overhead structure, additional structural design analysis is required to confirm overhead structure can support the equipment weight and to determine supports and connection types. This design analysis is Delegated Design, to be completed by the Contractor’s structural engineer. The cost of the Delegated Design and required supports and connections types for Communications Systems shall be included in the Contractor’s Bid.

B. Structural Analysis Requirements
   1. Structural analysis shall be performed by a structural engineer licensed in the state of the Project. Delegated Design submittals and Shop Drawings shall be stamped by this structural engineer.

1.14 PATENT FEES, ROYALTIES, PERMITS, AND TAXES

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others.

B. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

C. Unless otherwise provided in the Supplementary Conditions, Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

1.15 DELEGATION OF PROFESSIONAL DESIGN SERVICES

A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor’s responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Design Consultant will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed 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 Design Consultant.

C. Owner and Design Consultant shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design

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professionals, provided Owner and Design Consultant have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this Paragraph, Design Consultant's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents.

PART 2 - PRODUCTS

2.01 GENERAL PRODUCT REQUIREMENTS

A. Materials and equipment incorporated into the Work shall be as specified and of good quality and new, except as otherwise noted in the Contractor Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by these specifications or when requested by the Owner or Design Consultant, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

B. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

C. Performance Criteria
   1. Regulatory Requirements
      a. Utilize products listed by a National Recognized Testing Laboratory (such as UL), except where no relevant standard exists. These products shall bear a permanent mark/label of the NRTL.
      b. All equipment and material used in the installation shall be listed for the environment in which it is being installed. Examples – plenum-rated where installed in a return air plenum; wet or outdoor listed where installed in Wet or Damp Locations.
      c. Refer to individual sections and products for specific NRTL requirements.
   2. Sustainability Characteristics
      a. Refer to General Requirements / Division 1 for general Project and Product Sustainability requirements.
      b. Refer to individual Division 27 sections and products for specific Sustainability requirements.

D. Lead Time Issues
   1. Contractor shall review all products specified and required for this project to determine if there are any lead times for any products that may cause any delay. Contractor shall clearly identify any concerns with lead times in writing to the Architect/Design Consultant prior to submitting a Bid for this work. If the Contractor does not identify any concerns with products having long lead times, it will be understood there are no long lead time issues and the Contractor will have all products on-site when needed to complete the Work as required.

E. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer's part number.

F. In the event of a discrepancy between these Specifications and the Drawings, the greater quantity and/or better quality shall be assumed for Bidding purposes.

2.02 SUBSTITUTES AND "OR EQUALS"

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent,

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or “or-equal” item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to the Architect/Design Consultant for review under the circumstances described below.

1. “Or-Equal” Items: If in the Design Consultant’s sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Design Consultant as an “or-equal” item, in which case review and approval of the proposed item may, in Engineer’s sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:
    a. In the exercise of reasonable judgment the Design Consultant determines that:
        1) It is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
        2) It will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
        3) It has a proven record of performance and availability of responsive service.
    b. Contractor certifies that, if approved and incorporated into the Work
        1) There will be no increase in cost to the Owner or increase in Contract Times: and
        2) It will confirm substantially to the detailed requirements of the item named in the Contract Documents.
2. Substitute Items:
    a. If in the Design Consultant’s sole discretion an item of material or equipment proposed by Contractor does not qualify as an “or-equal” item under the Paragraph above, it will be considered a proposed substitute item.
    b. Contractor shall submit sufficient information as provided below to allow Design Consultant to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by the Design Consultant from anyone other than Contractor.
    c. Contractor shall make written application to the Architect/Design Consultant for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
        1) shall certify that the proposed substitute item will:
            a) perform adequately the functions and achieve the results called for by the general design,
            b) be similar in substance to that specified, and
            c) be suited to the same use as that specified;
        2) will state:
            d) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor’s achievement of Substantial Completion on time,
            e) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
            f) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
        3) will identify:
            g) all variations of the proposed substitute item from that specified, and
            h) available engineering, sales, maintenance, repair, and replacement services; and

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4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

d. Cost Reimbursement: in certain situations, evaluating a proposed substitution will require additional time by the Design Consultant. These situations will either be described in subsequent Specification sections, or conveyed in writing to the Contractor prior to evaluation by the Design Consultant. Design Consultant will record Design Consultant's costs in evaluating the proposed substitution. Whether or not Design Consultant approves the proposed substitution, Contractor shall reimburse Owner for the reasonable charges of Design Consultant for evaluating each proposed substitute. Contractor shall also reimburse Owner for the reasonable costs for Design Consultant, Architect, and Engineer(s) in making changes in the Contract Documents resulting from the acceptance of each proposed substitute.

B. Proposed equivalent items shall be approved by Design Consultant prior to purchase or installation. Proposed equivalent items shall meet or exceed these specifications and the specifications of the specified item.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Verification of Conditions
1. Prior to submitting a Bid, visit the project Site and existing facility (facilities) and become familiar with the conditions affecting the proposed scope of Work. Make provisions as to the cost associated with the existing conditions and include those costs in the Bid.
2. Existing Interior Conditions
   a. Refer to Existing Conditions paragraph in Part 1 of this Section.
3. Underground Facilities
   a. Shown or Indicated: The information and data shown or indicated in the Contract Documents with respect to existing Communications Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Design Consultant by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
      1) Owner and Design Consultant shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
      2) the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
         a) reviewing and checking all such information and data;
         b) locating all Underground Facilities shown or indicated in the Contract Documents;
         c) coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and
         d) the safety and protection of all such Underground Facilities and repairing any damage
         e) thereto resulting from the Work.
   b. Not Shown or Indicated:
      1) If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Architect/Design Consultant. Architect/Design Consultant will promptly review the Underground Facility and determine the extent, if any, to

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which a change is required in the Contract Documents to reflect and document the consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

B. Preinstallation Testing
   1. Refer to individual sections for requirements.

C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

D. No deviations from the Contract Documents shall be made without full consent in writing of the Architect/Design Consultant. The Contractor shall have written approval from the Architect/Design Consultant for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Design Contractor prior to proceeding with the work, the contractor shall not be reimbursed for the work.

E. Cleaning
   1. During the progress of the Work, Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations. Contractor shall dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.
   2. Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

F. Protection
   1. The Contractor shall protect Communications Work from damage by other trades and theft.
      a. Any Division 27 cabling that has more than 3-inches of paint on the jacket shall be replaced without additional cost to the Owner.
   2. Where owner-furnished or provided equipment is installed prior to Substantial Completion, access to that room or area shall be restricted/locked whenever unoccupied.

G. Power
   1. Prior to connecting any Communications equipment to a power receptacle, use a ground circuit impedance tester to confirm AC wiring and grounding has been installed correctly; confirm voltage and neutral-to-ground wiring are correct prior to energizing equipment. If not correct, notify Division 26 Contractor of the issue.

H. Temporary Power, HVAC, and Communications Systems
   1. Where owner-furnished or provided network equipment is required to be installed prior to Substantial Completion in order for Communications Systems Work to be functional, the room or area where that network equipment is installed shall be equipped with permanent or temporary power and heating/cooling at no additional costs to the Owner. Acceptable temperature range is 60 to 89 degrees Fahrenheit.
   2. When, through no fault of the Owner or Architect/Design Consultant, Communications Systems Work is not completed by Substantial Completion, temporary Communications Systems may be required while the Site is partially occupied by the Owner and shall remain installed until acceptance of permanent system(s); refer to individual sections for requirements.

3.02 INTEGRATION REQUIREMENTS

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A. Refer to individual sections for integration requirements.

3.03 REPAIR / RESTORATION

A. Contractor shall be responsible for the repair of any damage caused by the Contractor or Subcontractors during the installation.

B. Selective demolition may be necessary to facilitate installation of Communications Systems equipment and pathways. The Contractor shall obtain written permission from the Architect/Design Consultant before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings. After installation, Contractor shall restore floors, walls, roofs, and ceilings to their original condition.
   1. Avoid penetrations or installation of equipment onto or through waterproof assemblies such as roofs, exterior walls, and slab-on-grade floors. If installation cannot be avoided, install before waterproofing; protect installation area from weather/elements until sealing and waterproofing is complete.

3.04 WORK IN EXISTING FACILITIES

A. Coordinate work within existing facilities / areas with Owner a minimum of two weeks prior.

B. Perform selective demolition where noted on the Drawings; this includes the Division 27 equipment and devices identified on the Drawings (by symbol, note, or area) and associated cabling, conduit, pathways, and supports.
   1. Drawings will indicate locations where equipment, devices, cabling, conduit, pathways, and supports may be reused.
      a. Equipment, cabling, and devices that are to be reused shall be tested before selective demolition; submit Report to Owner and Design Consultant prior to selective demolition indicating non-working or damaged equipment, devices, and cabling. If no such Report is submitted, it shall be assumed all existing equipment, devices, and cabling were in working order prior to the start of the Work.
   2. Drawings indicate equipment and supporting materials that shall be salvaged (returned) to Owner.
   3. Remove existing cabling, conduit, pathways and supports back to the serving Communications / Equipment Room, except where shared with existing-to-remain cabling.
      a. Conduit and backboxes concealed or embedded in walls or floors may remain. Provide stainless steel cover over backbox openings that are not reused.
   4. Properly dispose of equipment and associated cabling, conduit, pathways and supports in compliance with local, state, and federal laws.
   5. Existing Division 27 equipment, devices, cabling, conduit, pathways, and supports that will be reused – or where Division 27 cabling, conduit, pathways and supports travels through a renovated area – shall be protected in place (safe from damage) during construction. Repair any damage to the satisfaction of the Owner without additional cost to the Owner.
      a. Existing devices/equipment in the renovated area may be temporarily removed, stored, and reinstalled.
      b. Where existing cabling, conduit, pathways and/or supports travelling through a renovated area must be disrupted, provide temporary system(s) or services for affected devices. Coordinate any downtime with Owner a minimum of two weeks before this Work.

C. Where demolition or renovation Work is adjacent to or within Owner-occupied areas, protect those areas with noise and dust barriers. Remove these barriers once demolition is complete.

D. For Work in existing Healthcare Facilities
   1. If not addressed in General Conditions / Division 1, Contractor shall perform the following:
      a. Request and conduct an infection control and risk assessment procedures coordination meeting with the Owner. This coordination shall include, but is not limited to, the following:

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1) Project Scope of Work, location, phasing and duration
2) Air and Pressure monitoring requirements
3) Containment and transportation of construction waste
4) Identification and coordination of any required Work outside the general construction area
5) Standard cleanup procedures (dry mop, wet mop HEPA-vacuum, disinfectant, etc)
6) Dust and noise control barrier locations and phasing
7) Personal protection equipment
8) Movement through/around sterile corridors
9) Final cleaning procedures
10) Daily and final documentation requirements

b. The Contractor shall document the Owner's requirements and procedures and develop/submit a site logistics plan for Owner approval. Work shall not start until this plan is approved.

3.05 FUNCTIONAL AND PERFORMANCE TESTING

A. After components have been installed, perform functional tests to ensure system components are installed and configured correctly in conformance with manufacturer's instruction and the Contract Documents. Correct any issues and retest. Include Test Report documentation in Preliminary and Final Project Closeout Submittals.

B. Third-party testing or manufacturer onsite services may be necessary for certain Division 27 systems or sub-systems; refer to individual sections for exact requirements.

C. Refer to individual sections for additional testing requirements.

3.06 FIELD OBSERVATIONS

A. A minimum of two weeks in advance, notify Design Consultant and Owner as to the readiness for a Field Observation for the following:
   1. Rough-In Observation – after conduits have been installed, but before walls have been installed.
   2. Above Ceiling Observation – after cabling has been installed, but before ceilings have been installed.
   3. Final Site Observation – a minimum of two weeks before Substantial Completion, to occur after Preliminary Project Closeout Submittal has been submitted.

B. Non-Conforming Work
   1. After receipt of written notice of defective Work, Contractor shall correct all defective Work, or, if the Work has been rejected by the Architect/Design Consultant, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages arising out of or relating to such correction or removal.

3.07 DEMONSTRATION, TRAINING, AND ADJUSTMENTS

A. Conduct training sessions to Owner's personnel to demonstrate system operation and preventative maintenance procedures.
   1. Refer to individual sections for additional training requirements.

B. After Owner has taken occupancy, Communications Systems equipment and components may require minor adjustments to be performed by the Contractor/Subcontractor to align with Owner's actual use of the systems. Refer to individual sections for specific adjustment requirements.

3.08 SOFTWARE, NETWORK, AND CYBERSECURITY REQUIREMENTS

A. Software Requirements
   1. All firmware found in products furnished or provided by the Contractor shall be the latest and most up-to-date provided by the manufacturer.

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2. All equipment requiring users to log on using a password shall be configured with user/site-specific password(s). No system/product default passwords shall be allowed. Coordinate user logins and passwords with Owner prior to system setup.
3. Refer to individual sections for additional software requirements.

B. Network and Cybersecurity Requirements
1. For all Communications Systems that have Contractor-provided equipment with an Ethernet/LAN port, Contractor shall coordinate with Owner's IT staff regarding Owner's network and cyber security requirements.
2. Within two weeks after Notice to Proceed, the Contractor (and/or Subcontractors for each Communications System) shall request an IT Coordination Kickoff Meeting with Owner's IT staff to ascertain and document Owner's requirements. Contractor shall document this meeting and send meeting minutes to all parties in attendance as well as Architect/Design Consultant.
3. At a minimum, coordinate the following network requirements for Contractor-provided equipment with the Owner's IT staff:
   a. IP address quantities and assignments for each equipment type and location, including subnets and subnet masks.
   b. PoE quantities and power requirements (PoE, PoE+, high powered PoE, etc) for each equipment type and location.
   c. Bandwidth requirements, including any prioritization or unicast/multicast requirements.
   d. VLAN use and assignment
   e. Encryption requirements
   f. WAN connection requirements
   g. Firewalls
   h. Planned approach for software upgrades and security patching.
   i. Follow additional network requirements and procedures as directed by the Owner's IT staff.
4. The Contractor shall take positive measures to prevent the introduction of cybersecurity threats to the Owner's technology infrastructure and network. These measures shall include but are not limited to:
   a. The Contractor shall scan contractor-provided or furnished equipment for cyber threats such as viruses, malware, ransomware, etc., prior to connecting the equipment to the Owner's network.
   b. Coordinate with the manufacturer to ensure newly procured equipment does not have any cybersecurity notices, bulletins, or alerts. Provide a letter to the Design Consultant with the submittal documents for that Specification section confirming there are no active or known cyber threats.
   c. Ensure all installers/technicians installing or configuring equipment are trained on the prevention of introduction of cyber threats to electronics.
   d. The Contractor shall assess whether or not there are any cyber threats / vulnerabilities associated with the specified equipment, prior to procurement/installation. If cyberthreats are discovered, notify the Design Consultant within one Day. Provide the make and model of the associated equipment and the vulnerability.
   e. Follow additional cybersecurity requirements and procedures as directed by the Owner's IT staff.
5. Refer to individual sections for additional Networking and Cybersecurity Requirements.

3.09 MAINTENANCE

A. Warranty Service

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1. Pursuant to Contractor's General Warranty and Guarantee, Owner may request Warranty Service for a period of 1 year after Substantial Completion for Communications Systems components due to faulty material or installation.
2. Upon written notice from Owner, promptly perform remedial / corrective Work to bring the associated system(s) to compliance with the Contract Documents and satisfaction of the Owner.
    a. In this context, "promptly" means within 7 Days, unless a quicker response and remediation time is specified in the associated Division 27 specification section.
3. Refer to individual sections for additional Warranty Service requirements.

B. One Year Warranty Check
1. 50 weeks after Substantial Completion, Contractor or Subcontractor for each Division 27 section shall conduct a site visit with Owner's facility personnel to ensure systems and components are still operating as intended / required by the Contract Documents. Promptly perform corrective Work while on site or within 7 Days.
    a. Pursuant to Contractor's General Warranty and Guarantee, corrective Work is not required if system / component is deficient due to:
        1) abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
        2) normal wear and tear under normal usage.

3.10 DRAWINGS AND SPECIFICATIONS AFTER SUBSTANTIAL COMPLETION

A. Contractor and any Subcontractor or Supplier shall not:
1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by Combs Consulting Group, LP, including electronic media editions; or
2. reuse any such Drawings, Specifications, other documents, or copies thereof on any other project without written consent of COMBS Consulting Group, LP.

B. The prohibitions in the paragraph above survive final payment, or termination of Contract. Nothing herein shall preclude Contractor or Owner from retaining copies of the Contract Documents for record purposes.

C. Physical paper copies of Drawings and Specifications shall be properly destroyed (shredded) when no longer needed to perform the Work.

END OF SECTION

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SECTION 270533
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section and the associated T, TA, TPA and TS Drawings and Contract Documents identify the requirements, technical design, and specifications for Pathways for Communications Systems for the Project. The conduit and backboxes shall be in compliance with the latest version of ANSI/TIA-569 and the locally adopted version of the NEC (National Electric Code) and shall include all components needed to ensure proper system performance and code compliance as specified.

B. Functionally complete pathways shall be provided in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result shall be provided whether or not specifically called for, at no additional cost to Owner.

C. The Pathways for Communications Systems includes the following main components:

1. Conduit / Sleeves and accessories
2. Backboxes
3. Floor Boxes / Poke-Thru Devices
4. Pull Boxes (Junction Boxes)
5. Wire-Mesh Cable Tray
6. Surface Raceways and Boxes
7. Firestopping Systems
8. Labeling

1.02 RELATED SECTIONS

A. Work required by this Section shall meet the requirements of Section 270010 General Requirements for Communications.

B. Refer to Division 26 for Electrical System requirements, including but not limited to additional material and installation requirements for Communications Systems conduit, backboxes, floor boxes, and pull boxes.

C. Refer to Section 271000 for associated Structured Cabling requirements.

D. Refer to Section 274116 for associated Audiovisual Systems requirements.

E. Refer to Section <insert other Div 27 sections> that will have pathway requirements.

1.03 CONFIDENTIALITY

A. Refer to Section 270010 for confidentiality requirements.

1.04 ABBREVIATIONS

A. ANSI – American National Standards Institute

B. TIA – Telecommunications Industry Association

C. NEC – National Electric Code

D. NECA – National Electrical Contractors Association

E. NEMA – National Electrical Manufacturers Association

F. NFPA – National Fire Protection Association

G. OSHA - Occupational Safety and Health Administration

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H. RMC – Rigid Metal Conduit

I. IMC – Intermediate Metal Conduit

J. EMT – Electrical Metallic Tubing

K. Refer to Section 270010 for additional abbreviations.

1.05 DEFINITIONS

A. Transition Point Enclosure

B. Refer to Section 270010 for additional definitions.

1.06 REFERENCE STANDARDS

A. Codes and Regulations
1. NECA – National Electrical Contractors Association
2. NFPA – National Fire Protection Association
3. OSHA – Occupational Safety and Health Administration
4. Refer to Section 270010 for additional Codes and Regulations.

B. Standards
1. NECA 1 – Standard for Good Workmanship in Electrical Construction
2. ANSI/BICSI N1- Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure
3. NECA/BICSI 607 – Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
4. ANSI/TIA-569 – Telecommunications Pathways and Spaces
5. ANSI/TIA-606 – Administration Standard for Telecommunications Infrastructure
6. ANSI/TIA-607 – Telecommunications Bonding and Grounding (Earthing) for Customer Premises
7. Refer to Section 270010 for additional Standards.

C. Guidelines
1. BICSI – Telecommunications Distribution Methods Manual
2. BICSI – Outside Plant Design Reference Manual
3. NEMA VE 2 - Metal Cable Tray Installation Guidelines
4. Refer to Section 270010 for additional Guidelines.

1.07 QUALITY ASSURANCE

A. Contractor Qualifications

9. The Contractor shall have been in business for a minimum of five (5) years.
10. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 75-mile radius of the project Site.
11. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.
12. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.
13. Firestopping Contractor Qualifications
    a. Firestopping materials shall be part of a UL listed System and installed by a certified technician.
    b. The Contractor/Subcontractor installing Firestopping shall be qualified and professionally trained with at least one of the following certifications:
        1) FCIA (Firestop Contractors International Association) – FM 4991 Approval
        2) UL Qualified Firestop Contractor
        3) Installation Certification through firestopping manufacturer.

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a) Specified Technologies, Inc products – all installers shall be FIT Level 1 Certified through STI.
b) Hilti products – The Contractor / Subcontractor shall be part of Hilti Firestop Specialty Contractor Program
c) Or Approved Equivalent

c. Submit proof of certification as part of Pre-Construction Submittal.

14. Refer to Section 270010 for additional Contractor Qualifications requirements.

B. Personnel Qualifications

15. At all times during the progress of the Work, the Contractor (or Subcontractor) responsible for the Work of this Section shall assign a competent Project Manager with the following qualifications / credentials:
    a. A minimum of five years of experience overseeing installation of Communications Pathways and who is familiar with the requirements of ANSI/TIA and BICSI Reference Standards listed above.
2. Include resume(s) of the above personnel per Submittal requirements and when requested by Owner or Design Consultant.

C. Site Observations

16. The Contractor's RCDD (per Section 271000 Structured Cabling) shall make weekly inspections during construction to ensure Pathways for Structured Cabling are installed properly and per the Contract Documents.
17. The Contractor's CTS-I/CTS-D (per Section 274116 Audiovisual Systems) shall make weekly inspections during construction to ensure Pathways for Audio Visual Systems are installed properly and per the Contract Documents.

1.08 WARRANTY

A. Refer to 270010 for General Warranty requirements.

B. Manufacturer Warranty
1. No additional manufacturer warranty is required beyond the Contractor's General Warranty and Guarantee.

C. Special Warranty
1. No special warranty is required for Pathways for Communications Systems.

1.09 SUBMITTALS

A. Refer to Section 270010 for General Submittal Requirements.

B. Pre-Bid
1. Submit clarifying questions and product Substitution Requests prior to the questions deadline prior to Bid.
2. Submit Contractor and Personnel Qualifications documentation indicating that the requirements of the Quality Assurance paragraph of this Section and Section 270010 are met.

C. Bid

18. Refer to Section 270010 for general Bid requirements.
19. Unit Pricing (CHECK WITH DARRYL) – See about Unit Pricing for MACs
    a. Include cost of pathways for Unit Pricing of Typical 2-port Data Outlet. Refer to Section 271000 for exact requirements of that Unit Pricing.
    b. <Insert additional unit pricing requirements.

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20. Allowances
    c. Include an allowance in Bid to perform <insert description of allowance #1.

D. Pre-Construction

21. Refer to Section 270010 for general Pre-Construction Submittal requirements and procedures.
22. Pre-Construction Submittal for this Section shall include the following:
    a. Bill-of-Materials
    b. Product Data
    c. Firestopping UL System information
    d. Shop Drawings
        1) Refer to Section 270010 for general Shop Drawing Requirements
        2) Shop Drawings for Work of this Section shall also include:
            a) Floor plans showing the following work:
                i.) Cable tray routing, size and height AFF. Cloud minor changes from Drawings and indicate reason for minor deviation – i.e., "Routed on west side of corridor due to conflict with mechanical duct." Submit RFI for major changes in routing – i.e., when coordination issues require cable tray to be routed in different room.

                ii.) Dimensioned multi-service floor box and poke thru device locations. For slab-on-grade floor boxes, also indicate quantity, size and routing of conduit under/in slab to serving Communications Room (for Structured Cabling) and to rack or accessible ceiling space (for Audio Visual).

            b) Pathways for Structured Cabling (including firestopping requirements identified by UL System number) shall be identified on Section 271000 Shop Drawings.
            c) Pathways for Audiovisual Systems (including firestopping requirements identified by UL System number) shall be identified on Section 274116 Shop Drawings.
            d) Pathways for ERRC DAS (including firestopping requirements identified by UL System number and where stretches of conduit require 2-hr fire-rated wrap) shall be identified on Section 275319 Shop Drawings.
    e. Structural Submittal – required for pathways over 200 pounds attached to overhead structure. Refer to Section 270010 for Structural Submittal requirements.
    f. Seismic Submittal – Refer to Section 270010 for Seismic Submittal requirements.

1.10 PROJECT CLOSEOUT

A. Refer to Section 270010 for general Project Closeout submittal requirements.

B. Project Closeout submittal for this Section shall include the following:

23. Bill-of-Materials / Product Index
24. Product Data
25. Operation and Maintenance Data
26. Warranty Documentation
27. Test Results
28. Training and Spare Parts

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a. Signed acceptance letter or form indicated Owner has been properly trained in operation of the system and has taken possession of the specified Spare Parts and Tools (items listed as “Furnish to Owner”).

29. Record Drawings (“As-Builts”)
   b. Maintain a copy of approved Shop Drawings on the Site (or the Project’s Construction Administration website), and update changes to pathways made during construction.
   c. At the conclusion of the project, utilize AutoCAD or BIM software (such as Revit or Navisworks) to incorporate the pathway changes to the Shop Drawings.
   d. PDF markups in software such as Bluebeam will not be acceptable.
   e. Include both PDF and AutoCAD (2018 dwg file type) versions of every drawing in the Project Closeout Submittal.

1.11 COORDINATION

A. Refer to Section 270010 for general Coordination requirements.

B. Coordination with other Divisions and Sections

30. Coordinate routing of cable tray with other trades prior to construction. Installation of cable tray without required clearances will not be accepted. Include in Bid cost of minor cable tray routing adjustments (within the same corridor) due to conflicts with other trades.

C. Preinstallation Meeting
   1. After Bid and before Preconstruction Submittals, request a Preinstallation Meeting with General Contractor and other Division 27 and 28 Subcontractors regarding Work specified in this Section.

1.12 STRUCTURAL AND SEISMIC REQUIREMENTS

A. Refer to Section 270010 for structural and seismic requirements.

1.13 NOISE CRITICAL SPACES

A. The following rooms are “noise critical spaces” and require special sound isolation requirements for sleeves and pathway wall penetrations through acoustically-rated walls:
   1. Music Teaching Rooms
   2. Sound / AV Control Rooms
   3. Courtrooms
   4. Conference Rooms
   5. Meeting Rooms
   6. Banquet Rooms
   7. <insert other room types>

B. Refer to details on Drawings and Parts 2 and 3 of this Section for Division 27 pathway sound isolation requirements.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Refer to Section 270010 for general product requirements.

2.02 CONDUIT / SLEEVES AND ACCESSORIES

A. Electric Metallic Tubing (EMT) and fittings
   1. Refer to Division 26 for specific product and material requirements.
   2. Shall meet ANSI C80.3, UL 797
   3. Manufacturers:
      a. Allied Tube or equivalent

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B. Intermediate Metal Conduit (IMC) and fittings
   1. Refer to Division 26 for specific product and material requirements.
   2. Shall meet ANSI C80.6, UL 1242
   3. Manufacturers:
      a. Allied Tube or equivalent

C. Rigid Metallic Conduit (RMC) and fittings
   1. Refer to Division 26 for specific product and material requirements.
   2. Shall meet ANSI C80.1, UL 6
   3. Manufacturers:
      a. Allied Tube or equivalent

D. Conduit Support / Fittings / Accessories
   1. Conduit Clamps
      a. Caddy Screw On Conduit Clips – For 1-inch – Part No. CS16
      b. Or equal
   2. 1-5/8” Framing System
      a. Unistrut Support Channel – Part No. P1000 T
      b. Or equal
   3. Conduit Bushings
      a. Nylon Bushings Sized for the Conduit Installed
   4. Innerduct
      a. Install size and type as identified on Drawings.
      b. 1” or 1-1/4” diameter
      c. Composed of HDPE (High Density Polyethylene)
      d. UL listed for Riser Plenum installation
      e. Footage markings every two feet
      f. With pull tape preinstalled
      g. Manufacturer:
         1) Innerduct
         2) Carlon
         3) Panduit
   5. Fabric Innerduct
      a. Textile innerduct
      b. Type (cell size and quantity) as identified on Drawings.
      c. UL listed for Riser installation
      d. With pull tape preinstalled in each cell
      e. Manufacturer:
         1) MaxCell – Riser
         2) No Substitutions

2.03 BACKBOXES

A. Size, Gang, and Trim Ring per Drawings

B. Boxes installed into stud walls:
   1. Single-gang:
      a. 2” by 3” by 2-1/2” deep
      b. Manufacturer: Dig into RACO part numbers
         1) RACO xxx
         2) Or equal from: xxx
   2. Double-gang:
      a. 4-11/16” by 4-11/16” by 2-1/8” deep

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b. With a minimum of 3/8” deep trim ring; depth to match thickness of gypboard wall material.
c. Manufacturer:
1) RACO xxx
2) Or equal from: xxx

3. TV Display backbox:
a. Specialty in-wall backbox
b. Minimum dimensions: 7” tall by 14.25” wide by 3.9” deep
c. With (2) 1-gang knockouts in top for power receptacle and data outlet
d. With a minimum of (1) 1-1/4” knockouts in top and bottom for AV conduits
e. With [white] [black] cover with slot openings for cables and ventilation
f. Manufacturer:
1) Chief PAC525FC (Check 526 w/cover)
2) FSR PWB-250
3) Or Approved Equal

4. TV Display backbox – shallow depth
a. Specialty in-wall backbox
b. Minimum dimensions: 7” tall by 14.25” wide
c. Maximum depth: 3”
d. With (2) 1-gang knockouts in top for power receptacle and data outlet
e. With a minimum of (1) 1-1/4” knockouts in top and bottom for AV conduits
f. With [white] [black] cover with slot openings for cables and ventilation
g. Manufacturer:
1) FSR PWB-253
2) Or Approved Equal

5. TV Display backbox – fire-rated wall
a. Specialty in-wall backbox
b. Minimum opening dimension: 10” by 8”
c. With (4) pre-wired electrical outlets (120V AC)
d. With (2) 1-1/2” knockouts in top and bottom for AV conduits
e. With [white] [black] cover with slot openings for cables and ventilation
f. [With bracket to install Crestron RMC device]
g. Manufacturer:
1) FSR PWB-FR-450
2) Or Approved Equal

C. Boxes installed into CMU (concrete masonry unit) walls:
1. Single-gang:
a. 2” by 3” by 3-1/2” deep
b. Manufacturer:
1) RACO xxx
2) No substitutions

2. Double-gang:
a. 2” by 3” by 3-1/2” deep
b. Manufacturer:
1) RACO xxx
2) No substitutions

D. Boxes installed in exterior / Wet locations:
1. Shall be die-cast aluminum
2. Manufacturer:
a. 1-gang: xxx
b. 2-gang: xxx

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E. Specialty AV Backboxes
   1. Size per Drawings
   2. Boxes identified by Manufacturer and Model number represent the Basis-of-Design. Alternate manufacturers will be considered; submit Substitution Request in compliance with Division 1.

2.04 FLOOR BOXES / POKE-THRU DEVICES

A. Multi-service Floor Box – Power and Data only
   1. Shall have a minimum of 4-gangs, with separate compartments for power and data.
   2. Shall accept (1) (2) 1-inch 1-1/4-inch conduit(s) reserved for data cabling.
   3. Stamped steel box, concrete-tight construction.
   4. Shall maintain fire-rating of floor.
   5. Provide power insert for every duplex indicated on Electrical Drawings.
   6. Provide decora-style opening insert for every four data jacks on Technology Drawings.
   7. Provide blank inserts for any unused gangs.
   8. Coordinate cover plate style and type with Architect.
   9. Manufacturer shall be:
      a. xxx

B. Multi-service Floor Box – Power and Data only – Slab-on-Grade locations
   1. Shall have a minimum of 4-gangs, with separate compartments for power and data.
   2. Shall accept (1) (2) 1-inch 1-1/4-inch conduit(s) reserved for data cabling.
   3. Cast iron box, watertight, Class 1 construction.
   4. Provide power insert for every duplex indicated on Electrical Drawings.
   5. Provide decora-style opening insert for every four data jacks on Technology Drawings.
   6. Provide blank inserts for any unused gangs.
   7. Coordinate cover plate style and type with Architect.
   8. Manufacturer shall be:
      a. xxx

C. Multi-service Floor Box – Shared Power, Data and Audio-Visual
   1. Refer to Section 274116 for AV Floor box requirements.

D. Multi-service Poke-Thru Device – Power and Data only
   1. 6-inch diameter flush-mounted poke thru
   2. 2-inch conduit opening for
   3. UL listed and UL fire classified to match rating of floor
   4. Provide power insert for every duplex indicated on Electrical Drawings.
   5. Provide decora-style opening insert for every four data jacks on Technology Drawings.
   6. Provide blank inserts for any unused gangs.
   7. Coordinate cover plate style and type with Architect.
   8. Manufacturer shall be:
      a. xxx

E. Multi-service Poke Thru Device – Shared Power, Data and Audio-Visual
   1. Refer to Section 274116 for AV Poke Thru Device requirements.

2.05 PULL BOXES (JUNCTION BOXES)

A. Sized per Part 3 of this Section

B. Metallic or steel construction

C. Removable cover. Boxes with a dimension greater than 24-inches shall have a hinged cover.

D. Interior locations: NEMA Type 1

E. Damp or Wet Locations (as defined by the NEC): NEMA Type 4

F. Manufacturer:

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1. NEMA Enclosures
2. Hoffman
3. Custom NEMA enclosures from sheet metal shop / fabricator
4. Or equivalent

2.06 SURFACE RACEWAYS AND BOXES

A. Metallic Surface Raceways
   1. Minimum cross-sectional area of low-voltage compartment shall be 1-square inch.
   2. Color and manufacturer shall match existing surface raceway installed in the room.
   3. Manufacturer shall be:
      a. Hubbell
      b. Wiremold
      c. Panduit
      d. Monosystems

B. Metallic Surface Box
   1. Single-gang or double-gang per Drawings
   2. Minimum interior depth shall be 2-1/2-inches.
   3. Color and manufacturer shall match existing surface raceway installed in the room.
   4. Manufacturer shall be:
      a. Same as Metallic Surface Raceway

C. Non-metallic Surface Raceways
   1. Minimum cross-sectional area of low-voltage compartment shall be 1-square inch.
   2. Color and manufacturer shall match existing surface raceway installed in the room.
   3. Manufacturer shall be:
      a. Hubbell
      b. Wiremold
      c. Panduit
      d. Monosystems

D. Non-Metallic Surface Box
   1. Single-gang or double-gang per Drawings
   2. Minimum interior depth shall be 2-1/2-inches.
   3. Color and manufacturer shall match existing surface raceway installed in the room.
   4. Manufacturer shall be:
      a. Same as Non-Metallic Surface Raceway

2.07 WIRE-MESH CABLE TRAY AND ACCESSORIES

A. Flexible, wire-mesh cable tray, with wire-mesh openings of approximately 2-inches by 4-inches, welded at all intersections. (Add parts and pieces, liners, color, etc.)

B. UL listed as an equipment grounding conductor.

C. Size per Drawings.

D. Utilize manufacturer-specific accessories as needed, including but not limited to:

E. Manufacturer:
   1. Chatsworth
   2. Cooper B-Line
   3. Hoffman
   4. Cablofil
   5. WBT
   6. Or Approved Equivalent

2.08 FIRESTOPPING SYSTEMS

A. Fire-Rated Pathway Device (Sleeve)

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1. Steel pathway (sleeve) with integral intumescent firestopping material to facilitate the initial installation - and frequent moves, adds, and changes - of low-voltage voice/data, fiber, video, security, paging, etc. cabling.
2. UL System meeting the hourly fire-rating of the wall or floor type
3. Multiple pathways in the same location shall be ganged together.
4. Plenum-rated
5. Manufacturer:
    a. Specified Technologies Inc – EZ Path Fire-Rated Pathway
        1) 2” – Series 22
        2) 3” – Series 33
        3) 4” – Series 44
    b. Hilti – Speed Sleeve
        1) 2” – CP 653 (2”)
        2) 4” – CP 653 (4”)

B. Firestopping for conduit penetrations
1. For metallic conduit or tube to be installed through 1 or 2 hr. fire-rated wall or floor.
2. Manufacturer:
    a. Gypsum board stud walls
        1) Specified Technologies - UL System No. W-L-1222 with Spec Seal LCI Sealant
        2) Or equivalent from Hilti
    b. Concrete floors or walls
        1) Specified Technologies – UL System No. C-AJ-1353 with Spec Seal LCI Sealant
        2) Or equivalent from Hilti

C. Firestopping for backboxes in fire- or smoke-rated wall
1. For Communications backboxes to be installed in 1 or 2 hr. fire-rated or smoke-rated walls.
2. STC sound rating – 64 or higher (related to specific construction)
3. Shall meet criteria of UL 263 and classified for up to hrs as a Wall Opening Protective Material (Category CLIV)
4. Manufacturer:
    a. Specified Technologies – Spec Seal Power Shield
    b. Or equivalent from Hilti

D. Smoke-Rated or Acoustical Sleeves
1. Metallic or non-metallic pathway (sleeve) with integral self-adjusting smoke and sound sealing system to facilitate the initial installation – and frequent moves, ads, and changes – of low-voltage voice/data, fiber, video, security, paging, etch cabling.
2. L Rating – Air Leakage Test Procedure tested per UL 1479 without a Fire Test
3. Less than 1.25 cubic feet per minute for 0% fill (cable) capacity
4. Less than 2.5 cubic feet per minute for 1 to 100% fill (cable) capacity
5. Sound Transmission Classification (STC) – 59 or higher (related to specific construction)
6. Plenum-rated
7. Manufacturer:
    a. Specified Technologies Inc – NEZ Pathway
    b. Hilti – Smoke and Acoustic Sleeve

E. Fire-rated Conduit (Circuit Integrity) Wrap
1. Endothermic wrap for EMT and RMC for protection of cable pathways for critical life safety circuits.
2. Tested to ASTM E1725 for circuit integrity
3. Manufacturer:
    a. Specified Technologies – E-Wrap Endothermic Wrap

2.09 LABELS

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A. Machine-printed, thermal-transfer type with self-adhesive

B. Text size for pathways shall be 3/8” tall.

C. Manufacturer:
   1. Brady
   2. Dymo
   3. Hellermann Tyton
   4. Panduit
   5. Or equivalent

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. General pathway requirements have been identified in the Contract Documents through the use of general notes, key notes, symbols, details, and Division 27 specifications. The Contractor is responsible for coordinating and providing required pathways to support all Division 27 Work in compliance with the Contract Documents. Coordinate exact pathway requirements with Subcontractors of all Division 27 Sections prior to Bid and include associated pathways in Bid.

B. Refer to Section 270010 for additional installation requirements.

3.02 CONDUIT / SLEEVES

A. The minimum conduit size shall be 1-inch.

B. EMT Conduit shall be used for all interior installations, unless otherwise noted.
   1. Where service provider entrance conduits do not enter the building in the same room the service provider cables will be terminated, entrance conduit routed within the building shall be IMC.

C. PVC conduit shall only be installed in concrete or underground exterior of the building. Underground conduit bends and sweeps shall be IMC or RMC.

D. For exposed conduit routing in Damp or Wet Locations (as defined by the NEC) or parking garages, conduit type shall be IMC or RMC with water-tight fittings and backboxes.

E. Conduit shall be sized as indicated on the Technology drawings. If no conduit size is indicated, then conduits shall be a minimum of 1-inch in diameter and sized per ANSI/TIA-569 – with maximum fill ratio of 40 percent.

F. Conduits shall not have more than the equivalent of (2) 90 degree bends or 180 degrees without the installation of a pull box or hand hole.

G. For Interior Installations – conduits shall have a pull-box installed when the conduit exceeds 100 feet.

H. For Exterior Underground Installations – conduits shall have a hand hole or maintenance hole installed when the conduit exceeds 500 feet.

I. All conduits and sleeves shall be reamed after cutting to ensure there are no sharp edges or burrs on the conduit that could damage the cable.

J. All conduits and sleeves shall have a nylon bushing installed on the open end(s) of the conduit.

K. Conduits and sleeves shall not be shared with any other discipline unless specifically approved in writing by the Architect/Design Consultant.

L. The Contractor is responsible for field coordination to ensure conduits and sleeves are separated from electrical conduits, and steam or hot water pipes: maintain a minimum clearance of 12-inches where routed parallel.

M. Unless indicated otherwise, all conduits shall be concealed under or within floor slabs, within finished walls, or above ceilings.

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N. All conduits shall be installed parallel with or at right angles to ceilings, walls, and structural members.

O. Conduits shall be routed concealed in walls, above suspended ceilings, in concrete slabs, or below grade. Exposed conduit is allowed only in exposed-to-structure areas without suspended ceilings and where specifically noted by the Contract Documents.

P. Restrictions Applicable to EMT
   1. Do not install underground.
   2. Do not encase in concrete, mortar, grout, or other cementitious materials.
   3. Do not use in areas subject to severe physical damage including but not limited to equipment rooms where moving or replacing equipment could physically damage the EMT.
   4. Do not use outdoors.

Q. Install and bond in accordance with NFPA 70 and ANSI/TIA-569. In addition, bond telecommunications conduit in accordance with ANSI/TIA-607.
   1. Conduits that stub into Communications Rooms shall be bonded to Telecom Ground Bar in Communications Rooms. Utilize #6 AWG conductor for lengths up 13 feet, a #4 AWG conductor for lengths of 14 to 20 feet, and a #3 AWG conductor for lengths of 21 to 26 feet with listed two-hole compression or exothermic lugs at Ground Bar. Provide pipe grounding connector at conduit. Refer to ANSI/TIA-607 standard for conductor size requirements for lengths longer than 26 feet.

R. Conduit Through Floor Slabs - Where conduits rise through floor slabs, curved portion of bends shall not be visible above finished slab.

S. Directional Changes in Conduit Runs
   1. Make changes in direction of runs with symmetrical bends
   2. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits.
   3. Prevent plaster, dirt, or trash from lodging in conduits, boxes and fittings during construction. Free clogged conduits of obstructions.

T. Sleeves through floors shall be rigidly supported utilizing a cast-in-place as the preferred method or using a unistrut rack system and shall extend through either side of the ceiling/floor a minimum of 4-inches.

U. Sleeves through walls shall be rigidly fastened to the studs and extend a minimum of 4-inches on either side.

V. Install each conduit longer than 5 feet with a nylon pull string with a minimum tensile strength of 200 lbs.

W. Conduit and Sleeve Supports
   1. Support conduit and sleeves in underground installations using 2-inch duct spacers.
   2. Support conduit and sleeves in interior installations using pipe straps, wall brackets, hangers, or ceiling trapeze.
   3. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work.
   4. Do not support conduit by ceiling support system. Conduit and box systems shall be supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed.
   5. Supporting means shall not be shared between telecommunication raceways and electrical raceway, mechanical piping or ducts.
   6. Installation shall be coordinated with above-ceiling electrical and mechanical systems to assure maximum accessibility to all systems.
   7. Conduit and sleeves shall be supported by a trapeze or wall support brackets.

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8. A minimum of 3/8-inch all-thread shall be used for trapeze supports.
9. Support in accordance with NFPA 70 at intervals not to exceed three feet from the box and every 10 feet afterwards.
10. Conduit and sleeves shall be no less than 3-inches above a lay-in ceiling.
11. Conduit and sleeves shall be rigidly supported and level.
12. All supports shall attach to structure or a rigid surface.
13. Supports shall not be shared with any other discipline unless specifically approved by the Architect/Design Consultant.

X. Fabric Innerduct
1. If the Contractor has not previously installed fabric innerduct, contact the manufacturer prior to installation for free installation support offered by the manufacturer:

3.03 BACKBOXES

A. Locknuts and Bushings
1. Fasten conduits to sheet metal boxes with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least minimum single locknut and bushing.
2. Locknuts shall have sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits and provide insulating type where required by NFPA 70.

B. Provide boxes in communication raceway systems at least every 100 feet and /or when 180 degrees in bends are exceeded when installing conduit on the interior of a building.

C. Boxes for metallic raceways shall be cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, or when surface mounted on interior walls exposed up to 7 feet above floors and walkways, and when specifically indicated.

D. Boxes in other locations shall be sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system.

E. Boxes for telecommunications shall be minimum 4 11/16 inches square and 2 1/8 inches deep.

F. Boxes for use in masonry-block or tile walls shall be square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers.

G. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces.

H. Backbox Supports
1. Backboxes installed in a sheet rock wall or ceiling shall be supported using the Caddy box mounting bracket or equivalent.
2. Support boxes installed flush in suspended ceilings tiles with T-bar bracket/bridge connected to ceiling grid.
3. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. Threaded studs driven in by powder charge and provided with lock washers and nuts or nail-type nylon anchors may be used in lieu of wood screws, expansion shields, or machine screws. In open overhead spaces.
4. Boxes installed in a wall shall be flush with the wall upon completion.
5. Mounting Heights of Boxes
a. Mount telecommunications outlets at height(s) as indicated on the Technology Drawings.

3.04 FLOOR BOXES / POKE-THRU DEVICES

A. Coordinate insert requirements with Division 26 prior to Pre-Construction Submittal.

B. Indicate conduit stub-up location on pre-construction shop drawings and as-built drawings.

3.05 PULL BOXES / JUNCTION BOXES

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A. Support sheet metal boxes directly from building structure or by bar hangers.

B. Boxes mounted overhead shall be no more than 5 feet above accessible (lay-in) ceiling.

C. Pull boxes for concealed conduits routed above inaccessible ceiling shall be accessible via an access panel. Confirm acceptable location in writing with Architect/Design Consultant prior to installation. Review reflected ceiling plans prior to Bid and include associated costs for additional access panels for required pull boxes for communications conduit with Bid.
   1. Access panels shall be 30” by 30”; color, style, manufacturer as approved by Architect.

D. Size pull boxes per the following table:

E.

Conduit Trade Size	Width	Length	Depth	Width Increase for Additional Conduit (of same size)
1"	4"	4"	2-1/8"	Not applicable
1-1/4"	6"	20"	3"	3"
1-1/2"	8"	28"	4"	4"
2"	8"	36"	4"	5"
2-1/2"	10"	42"	5"	6"
3"	12"	48"	5"	6"
4"	16"	60"	8"	6"

F. Transition Point Enclosure
   1. Where conduit for slab-on-grade floor boxes is not routed underground to serving Communications Rooms and instead stubs up into accessible ceiling space a transition point enclosure is required.
   2. Transition Point Enclosure requirements:
      a. 24” x 12” x 12” (minimum size) NEMA 1 enclosure with 1RU, 2RU, or 3RU wall bracket (Chatsworth 11583-719, Middle Atlantic VPM-2, or equal).
      b. Enclosure shall be located above accessible (lay-in) ceiling.
      c. Conduit from floor box shall stub directly into enclosure.
      d. Provide knockout bushings for number of 1” knockouts to support number of cables installed.
      e. Each Transition Point Enclosure can support multiple floor boxes, up to 20 total Category cables.

3.06 SURFACE RACEWAYS AND BOXES

A. Surface Raceways and Boxes are not allowed, except where specifically identified on the Drawings.

B. Where surface raceway meets the ceiling, provide “boot” accessory.

C. Attach back part of surface raceway to wall every 4 feet or less with screw or other appropriate form of permanent installation. Use of adhesive to mount raceway to the wall is prohibited.

D. Coordinate color of surface raceway and boxes with existing / other trades and match color exactly.

3.07 WIRE-MESH CABLE TRAY

A. Coordinate with all other disciplines to ensure cable tray routing and installation is coordinated with other systems.

B. Coordination with all other disciplines to ensure the 12-inch clearance above the tray is maintained.

C. Any elevation changes shall have radius drops installed to support the cables properly.

D. Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Utilize 45-degree off-sets/routing to change elevation and horizontal routing.

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E. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

F. Where cable trays encounter a non-fire-, smoke-, or acoustically-rated wall, cut opening through wall to facilitate continuous cable tray installation through wall.

G. Where cable trays encounter fire, smoke, or acoustic-rated wall, stop cable tray and provide Fire-or Smoke-Rated Pathway Devices. Provide number of devices to match square-inch capacity of cable tray. Devices shall be ganged together with manufacturer-specific accessory.

H. Where cable trays encounter more than 10 feet of inaccessible (gypsum board) ceiling, stop cable tray and provided number of 4” conduits over inaccessible ceiling to match square-inch capacity of cable tray, per the following table:

I.

Cable Tray Size	Quantity of 4” Conduits
2”x8”	2
2”x12”	3
4”x12”, 2”x24”	4
4”x18”, 6”x12”	5
4”x24”, 6”x18”	7
6”x24”	10

J. Ground and bond cable tray in accordance with NFPA 70 and ANSI/TIA-607.
   1. Bond cable tray to the Telecom Ground Bar in each Communications Rooms. Utilize #6 AWG conductor for lengths up 13 feet, a #4 AWG conductor for lengths of 14 to 20 feet, and a #3 AWG conductor for lengths of 21 to 26 feet. Refer to ANSI/TIA-607 standard for conductor size requirements for lengths longer than 26 feet.
   2. Provide ground lugs between each section of cable tray to ensure electrical continuity of cable tray installation. Where cable tray sections are separated by conduit or firestopping sleeves, provide #6 AWG bonding jumper between cable tray sections.

K. Cable Tray Supports
   1. Cable tray shall be supported by a trapeze or wall support brackets. No center support brackets shall be allowed.
   2. A minimum of 3/8-inch all-thread shall be used for trapeze supports.
   3. Support in accordance with manufacturer recommendations but at not more than 10 foot intervals.
   4. Cable tray shall be no less than 3-inches above a lay-in ceiling.
   5. Cable tray shall be rigidly supported and level.
   6. All-thread shall be covered from the attachment to the trapeze system to 3-inches above the tray to protect the cables from being chaffed.
   7. All supports shall attach to structure or a rigid surface such as a plywood backer in a sheet rock wall.
   8. Supports shall not be shared with any other trades unless otherwise noted.

3.08 FIRESTOPPING

A. Fire-Rated Pathway Devices
   1. Provide Fire-Rated Pathway Device(s) wherever Communications cabling routed above accessible ceiling needs to be routed through a fire-rated wall. Quantity and size of devices shall be sized per manufacturer’s published cable fill counts, leaving 25% spare capacity.
   2. Coordinate quantity, size and locations with other Division 27 Subcontractors and indicate quantity, size, location, product make and model number, and UL System number on Pre-Construction Shop Drawings.

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3. Coordinate quantity, size and locations with other Division 27 Subcontractors and indicate quantity, size, location, product make and model number, and UL System number on Pre-Construction Shop Drawings.
4. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

B. Firestopping for Conduits
1. Provide firestopping components as part of a UL System for all conduit penetrations through fire-rated and smoke-rated walls and floors.
2. Coordinate locations and UL System with other Division 27 Subcontractors and indicate locations and UL System number on Pre-Construction Shop Drawings.
3. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

C. Firestopping for Backboxes
1. Provide firestopping component(s) as part of a UL tested/approved solution for backboxes located in fire-rated and smoke-rated walls.
2. Coordinate locations with other Division 27 Subcontractors and indicate locations on Pre-Construction Shop Drawings.

D. Smoke-Rated / Acoustical Pathway Device
1. Provide Smoke-Rated Pathway Device(s) wherever Communications cabling routed above accessible ceiling needs to be routed through a smoke-rated wall or through a wall of a Noise Critical Room.
2. Quantity and size of devices shall be sized per manufacturer's published cable fill counts, leaving 25% spare capacity.
3. Coordinate quantity, size and locations with other Division 27 Subcontractors and indicate quantity, size, location, product make and model number, and UL System number on Pre-Construction Shop Drawings.
4. For smoke-rated partitions: Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

E. Fire-rated Conduit (Circuit Integrity) Wrap
1. Provide Fire-rated Conduit (Circuit Integrity) Wrap for certain Communications conduits for the following systems:
   a. Section 275129 Two-Way Communications System
   b. Section 275319 Emergency Responder Radio Coverage (ERRC) DAS
2. Coordinate conduit size and lengths requiring wrap with Subcontractors of those sections prior to Bid and include cost to provide that wrap in the Bid.

3.09 LABELING

A. Wherever communications conduits stub up into Communications Room, either through the floor or wall), provide label on bottom/front half of conduit indicating communications system and far end location. Example: DATA FROM FRONT DESK FLOORBOX. At far end of these conduits, provide label indicating communications system and room name and room number. Example: DATA TO MDF 123.

B. Wherever communications conduits are installed overhead due to runs over inaccessible ceilings, provide label on bottom half of conduit at each end of the conduit indicated communications system and far end location. Example: HORIZONTAL CABLE TO LOBBY 251.

C. Provide label on cover of each pull box / junction box identifying communications system cabling and destinations. Example: BACKBONE CABLE FROM MDF 123 TO IDF 456.

3.10 FUNCTIONAL AND PERFORMANCE TESTING

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A. Refer to Section 270010 for general Functional and Performance Testing requirements.

B. The following additional testing requirements shall be provided:
   1. Cable Tray Two-Point Ground/Continuity Testing
      a. Prior to the two-point ground testing, a visual inspection shall be performed to verify that the bonding and grounding system is installed according to the Contract Documents and in compliance with the ANSI/TIA-607 Standard.
      b. All testing shall be conducted prior to any active equipment being installed.
      c. The Contractor shall use an earth ground resistance tester that is configured for a continuity test. This is also known as a two-point tester or a “dead earth” test.
      d. Prior to the two-point continuity test conduct a voltage test to ensure there is no stray voltage in the system.
      e. The testing shall include but is not limited to the following points.
         1) Cable tray to electrical ground in ER/TR.
         2) Cable tray to the building steel (if present).
         3) Cable tray to each SBB/TGB.
      f. Per the ANSI/TIA-607, the maximum value for resistance between any point in the telecommunications bonding and grounding system and the building’s electrical grounding electrode system is 100 milliohms. In the case of long conductor runs, the resistance of the conductor must be factored into the total resistance. For example, 1 km of a No. 3/0 conductor has a resistance of 0.2028 ohms. (0.06180 ohms per 1000 ft.)

3.11 FIELD OBSERVATIONS

A. Refer to Section 270010 for Field Observation requirements.

3.12 DEMONSTRATION, TRAINING, AND ADJUSTMENTS

A. Refer to Section 270010 for general Demonstration, Training, and Adjustment requirements.

B. Provide the following additional requirements:
   1. Conduct (1) 1-hour site walk with Owner after pathways have been installed but prior to installation of suspended ceiling; point out pathway and pull box locations.

3.13 MAINTENANCE

A. Refer to Section 270010 for Warranty Service and One Year Warranty Check requirements.

END OF SECTION

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SECTION 271000
STRUCTURED CABLING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. This section identifies the requirements, technical design, and specifications for the structured cabling system at the Willis ISD, Turner Elementary School Renovation in Willis, Texas (“Owner”). The structured cabling system as specified is an Industry-Standard Category 6A structured cabling system and includes backbone cabling, horizontal cabling and equipment room hardware as specified.

B. The Contractor shall provide a minimum Manufacturer’s 20-Year Performance Certification for the installed structured cabling system, certified by CommScope Uniprise for fiber and copper.

C. Contractor shall include materials, equipment, and labor necessary to provide a complete and functional structured cabling system regardless of any items not listed or described in this specification or associated drawings.

1.02 REQUIREMENTS TABLE OF CONTENT

A. Contractor Experience Requirements

B. Submittal Requirements

C. Acceptable Manufacturers

D. Codes, Standards and Regulations

E. General Requirements

F. System Requirements

G. Testing Requirements

H. Project Closeout Documentation

I. Attachments

1.03 RELATED REQUIREMENTS

A. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27, and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents, and shall coordinate them with the work on the project.

B. Contractor Experience Requirements

1. The Contractor shall be a CommScope Uniprise Partner prior to submitting a bid for the work.
2. The Contractor shall possess all relevant Manufacturer Certifications (i.e. structured cable systems, testing equipment, etc,) for both the company and individual technicians prior to submitting a bid for the work.
3. The Contractor’s Project Manager shall be a Registered Communications Distribution Designer (RCDD) and available for all on-site coordination meetings.

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4. The Contractor shall have been in business for a minimum of five (5) years.
5. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 100-mile radius of the project site.
6. The Contractor shall have completed a minimum of three (3) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

C. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.

1.04 SUBMITTAL REQUIREMENTS

A. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Design Consultant.
2. Contractor shall ensure submittals are submitted in a timely manner to ensure all products can be ordered and received on site in order to not cause any delays. If there are any concerns with any products having long lead times, those products shall be clearly identified in writing so the review and approval can be expedited.
3. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e. product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will not be approved.
4. Manufacturer product data sheets for each proposed system component.

    a. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted. Product data sheets without the part number clearly identified will not be approved.

5. Manufacturer Product Certifications for Company.
6. Manufacturer Product Certifications for Installers.
7. Manufacturer Certifications for testing equipment technicians.
8. Manufacturer Certifications for testing equipment calibration.
9. RCDD Certificate for Contractor's Project Manager.
10. Manufacturer Warranty letter.
11. Documentation indicating that Contractor has been in business for (3) years.
12. Address of Contractor's local office within a 100-mile radius of the project site.
13. Quantity of full time local technicians within a 100-mile radius of the project site.
14. List of three (3) contractor-installed projects of a similar size and scope that have been in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.
15. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, and Brief Description of Project.
16. List of subcontractors performing any work on the project. The list shall clearly identify the subcontractor's legal name and address, the scope of work to be performed by the subcontractors and the overall percentage of the project being provided by the subcontractor. If there are no subcontractors performing any work on the project, submit a statement on company letterhead clearly indicating no subcontractors will be performing any work on this project.

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17. Contractor shall maintain a set of shop drawings on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Design Consultant.
18. Contractor shall submit a line, by line specification review acknowledging conformance to the contract documents If any variances are taken due to a product being discontinued or factory recommended replacement for product reaching end of life the contractor shall note it on the review as a variance. The specified products will be itemized and listed as an attachment.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Architect/Design Consultant will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

C. Proposed equivalent items must be approved in writing by the Architect/Design Consultant prior to purchase or installation. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer's part number and add the required information to the submittal package.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

G. All wiring, equipment, and installation materials shall be new and of the highest quality.

H. Labels on all cabling, materials, and equipment must indicate a nationally recognized testing laboratory.

I. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Design Consultant which certifies performance characteristics and compliance with ANSI/TIA 568-D standards.

J. Contractor shall review all products specified and required for this project to determine if there are any lead times for any products that may cause any delay. Contractor shall clearly identify any concerns with lead times in writing to the Architect/Design Consultant prior to submitting a proposal for this work. If the Contractor does not identify any concerns with products having long lead times, it will be understood there are no long lead time issues and the Contractor will have all products on-site when needed to complete the job as required.

2.02 FIBER OPTIC BACKBONE CABLE

A. Plenum

1. Interlocking Armored Cable, Plenum, 12 F, Singlemode (OS2) –

    a. CommScope Part Number P-012-DZ-8W-FSUYL

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2.03 COPPER BACKBONE CABLE

A. Indoor/Outdoor

1. 50-pair Category 5e 24 AWG Unshielded Twisted Pair (UTP)

a. Superior Essex Part # 09-100-02

2.04 HORIZONTAL CABLE

A. Category 6A UTP Plenum

1. Network Access (Blue Sheath) (Use Plenum where Applicable)

a. CommScope Part # UN874035114/10

2. Wireless Access (Yellow Sheath)

a. CommScope Part # UN874050014/10

3. Cameras (Orange Sheath)

a. CommScope Part # UN874015814/10

4. HVAC & BMS (Green Sheath)

a. CommScope Part # UN874035914/10

5. Indoor/Outdoor (Black Sheath)

a. CommScope Part # CS44P-IO

2.05 FIBER OPTIC CABLE TERMINATION

A. Fiber Enclosure

1. Fiber Optic Enclosure –

a. CommScope Part # 760249997

B. Optical Fiber Connector

1. Qwik-Connect LC Fiber Optic Connector (Blue), OS2 (Singlemode)

a. CommScope Part # 760117895

C. Optical Fiber Coupler Panels

1. Fiber bulkhead panels/Blank panels

a. Manufacturer: CommScope
1) CommScope Part # 760148254
2) Blank = CommScope Part # 760147736

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2.06 CATEGORY 6/6A HORIZONTAL RACK MOUNTED PATCH PANELS

A. Network Access - 19-inch rack mounted Cat 6A Universal Patch Panel. Cable management bar included. Complies with ANSI/TIA-568-2.D Category 6A performance. Terminate using T568-B pin out. Complete with wire management bars and designation strips.

1. CommScope 48 Port Patch Panel

a. (110-style 2RU 48-port standard flat panel) Part # CPP-UDDM-M-2U-48

B. Wireless Access - 19-inch rack mounted Cat 6A Universal Patch Panel. Cable management bar included. Complies with ANSI/TIA-568-2.D Category 6A performance. Terminate using T568-B pin out. Complete with wire management bars and designation strips.

1. CommScope 48 Port CAT6A Patch Panel

a. (110-style 2RU 48-port standard flat panel) Part # CPP-UDDM-M-2U-48

C. Cameras - 19-inch rack mounted Cat 6A Universal Patch Panel. Cable management bar included. Complies with ANSI/TIA-568-2.D Category 6A performance. Terminate using T568-B pin out. Complete with wire management bars and designation strips.

1. CommScope 48 Port CAT6A Patch Panel

a. (110-style 2RU 48-port standard flat panel) Part # CPP-UDDM-M-2U-48

2.07 CATEGORY 6 / 6A MODULAR JACKS

A. Category 6A, 8-position modular jack, IDC terminals, T568A/B wiring scheme. The modular connector shall exceed all component performance requirements in the ANSI/TIA-568-D.2 standard for Augmented Category 6 from 1 MHz to 500 MHz. Outlet wired with standards compliant T568-B pin out. Suitable to be mounted in corresponding faceplate, mounting plate or surface mount box.

1. Manufacturer: CommScope
2. Type:

a. Cat 6A Uniprise Connector, Yellow for Wireless Access Points
a) Part # UNJ10G-YL

b. Cat 6A Uniprise Connector, Blue for General Use
a) Part # UNJ10G-BU

c. Cat 6A Uniprise Connector, Orange for Cameras
a) Part # UNJ10G-OR

d. Cat 6A Uniprise Connector, Green for HVAC
a) Part # UNJ10G-GN

2.08 CATEGORY 6 BUILDING ENTRANCE PROTECTORS

A. Category 6 Building Entrance Protector – Wall-Mounted

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1. Solid state building entrance protector for Category 6 cables serving outlets on the exterior face and outside of the building
2. Approved per UL497 and UL497B
3. Shall support a minimum of 1G-BASE-T and Power-over-Ethernet applications
4. Manufacturer:

    a. Ditek – DTK-VM6WM
    b. Or equal from ITWLinx
    c. Or Approved Equivalent

B. Category 6 Building Entrance Protector – Rack-Mounted

1. Solid state building entrance protector for Category 6 cables serving outlets on the exterior face and outside of the building
2. Approved per UL497 and UL497B
3. Shall support at least 1G-BASE-T and Power-over-Ethernet applications
4. Rack-mounted
5. RJ45 in and out
6. Manufacturer:

    a. Ditek DTK-RM12ETHS
    b. Or equal from ITWLinx
    c. Or Approved Equivalent

C. Category 6 In-Line Surge Suppression – at Device end

1. Shielded surge protector
2. Approved per UL497B
3. Shall support at least 1G-BASE-T and Power-over-Ethernet applications
4. RJ45 in and out
5. Manufacturer:

    a. Ditek – DTK-MRJEXTS
    b. ITWLinx – CT6-POE-RJ45
    c. Or Approved Equivalent

2.09 TELECOMMUNICATIONS FACEPLATES

A. Coordinate color with Architect prior to ordering.

1. Outlet faceplate suitable to be installed over a standard NEMA electrical junction box, capable of mounting approved flat 8-pin modular connectors and coaxial connectors.

    a. Manufacturer: CommScope
    b. Type:
        1) Single-Gang Wall Plate with ID Windows, White = Part # M14L-262

2. Outlet box suitable to be surface mounted, capable of mounting approved 8-pin modular connectors and coaxial connectors.

    a. Manufacturer: CommScope
    b. Type:
        1) Surface-Mount Box, 1-Port, White = Part # SMB-1P-262
        2) Surface-Mount Box, 4-Port, White = Part # 107952459

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3. 2-Port, QuickPort in-ceiling bracket with clip for drop wire/rod mounting. Compatible with QuickPort Surface-Mount Boxes (fasteners included with bracket, boxes sold separately). Brackets must be installed on a dedicated drop wire/rod per NEC® 300.11.

    a. Manufacturer: Leviton
    b. Type:
        1) In-ceiling Bracket, 2-Port = Part # 49223-CBC

2.010 PATCH CABLES

A. LC to LC 50 micron Multi-mode Fiber Patch Cords

1. Physical Specifications: Duplex multi-mode optical fiber cable patch cords, terminated with LC connectors on both ends.
2. Performance Characteristics: Superior to the individual characteristics established in ANSI/TIA-568-3.D – Optical Fiber Cabling Components Standard optical fiber cable performance. Equal to or greater than the performance characteristics of cables specified under this work.

    a. Manufacturer: CommScope
    b. Type:
        1) (OS2) LC to LC, 1 meter = Part # 1966319-1
        2) (OS2) LC to LC, 2 meter = Part # 1966319-2
        3) (OS2) LC to LC, 3 meter = Part # 1966319-3

B. Copper Patch Cables

1. Equipment Room / Telecommunications Rooms

    a. CommScope Part # UC1AAA2-09FXXX where xxx equals length in feet (Wireless Access Points)
    b. CommScope Part # UC1AAA2-0ZFXXX where xxx equals length in feet (Data)
    c. CommScope Part # UC1AAA2-06FXXX where xxx equals length in feet (Video Surveillance)
    d. CommScope Part # UC1AAA2-0MXXX where xxx equals length in feet (HVAC & BMS)

2. Workstations

    a. CommScope Uniprise CAT 6A U/UTP Patch Cords – Part Number UC1AAA2-0ZFXXX (blue)
    b. CommScope Uniprise CAT 6A U/UTP Patch Cords – Part Number UC1AAA2-06FXXX (Orange)
    c. CommScope Uniprise CAT 6A Patch Cords – Part Number UC1AAA2-0MFXXX (Green)
    d. CommScope Uniprise CAT 6A Patch Cords – Part Number UC1AAA2-09FXXX (Yellow)
    e. * For Lengths 1 to 20 feet (increments of one foot)
    f. Contractor shall verify Patch Cord quantity and lengths shall be verified with the owner prior to purchase.

2.011 EQUIPMENT RACKS, CABINETS, CABLE MANAGEMENT, AND ACCESSORIES

A. Equipment Racks

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1. Chatsworth Products Inc. or approved equivalent, 19”X 35’’ wall rack, black

    a. Chatsworth Part # 11791-718

B. Four-Post Rack - 19” x 84” Open Frame (Black)

1. Shall be same manufacturer as Two-Post Rack
2. Manufacturer

    a. Chatsworth – PROVIDED BY OWNER.

C. Wall-mounted equipment cabinet

1. Fully enclosed cabinet, with locking front door and locking rear swing-out functionality.

    a. PROVIDED BY OWNER AND DIVISION 27 CONTRACTOR WILL ASSEMBLE AND INSTALL.

D. Vertical Cable Managers

1. Provide 6-inch wide, dual-sided Vertical Cable Manager at both ends of a row of equipment racks in the MDF and each IDF.
2. Provide 8-inch wide, dual-sided Vertical Cable Managers between each equipment rack.
3. Shall have integral cover/door on both sides.
4. Manufacturer:

    a. Chatsworth Evolution g2
        1) 6-inch wide: 35521-703 with floor bracket (35506-701
        2) 8-inch wide: 35522-703 with Cable Divider Bar Kit (35503-701)

E. Horizontal Cable Managers (Black)

1. Chatsworth Rack Cabling Manager - Part Number 30530-719

F. Vertical Power Strip for 7’ Equipment Rack

1. Provide one vertical power strip per 2-post and 4-post rack.
2. Chatsworth 24 Outlet (5-20R) Power Strip with Meter and NEMA 5-20P – Part Number 12848-755

2.012 CABLE RUNWAY (LADDER TYPE)

A. Universal Cable Runway

1. 12-inch Chatsworth - Part Number 10250-712
2. Or approved equal from 2-post rack manufacturer

B. Cable Runway Radius Drop, Cross Member

1. 18-inch Chatsworth - Part Number 12100-712
2. Or approved equal from 2-post rack manufacturer

C. Cable Runway Radius Drop, Stringer

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1. Chatsworth - Part Number 12101-711
2. Or approved equal from 2-post rack manufacturer

D. Cable Runway Butt-Splice Kit

1. Chatsworth - Part Number 11301-701
2. Or approved equal from 2-post rack manufacturer

E. Cable Runway Junction-Splice Kit

1. Chatsworth - Part Number 11302-701
2. Or approved equal from 2-post rack manufacturer

F. Cable Runway Butt-Swivel Splice Kit

1. Chatsworth - Part Number 10487-701
2. Or approved equal from 2-post rack manufacturer

G. Rack-to-Runway Mounting Kit

1. 15 to 18-inch runway Chatsworth - Part Number 10595-712
2. Or approved equal from 2-post rack manufacturer

H. Cable Runway Elevation Kit for Racks

1. Chatsworth - Part Number 10506-706
2. Or approved equal from 2-post rack manufacturer

I. Triangular Support Bracket, Aluminum

1. 12 to 18-inch runway Chatsworth - Part Number 11312-712
2. Or approved equal from 2-post rack manufacturer

J. Wall Angle Support Kit, Cable Runway

1. 18-inch runway Chatsworth - Part Number 11421-712
2. Or approved equal from 2-post rack manufacturer

K. 90 Degree Runway-Splice Kit

1. Chatsworth - Part Number 11314-701
2. Or approved equal from 2-post rack manufacturer

L. 45 Degree Runway-Splice Kit

1. Chatsworth - Part Number 11313-701
2. Or approved equal from 2-post rack manufacturer

M. Foot Kit, Cable Runway

1. Chatsworth - Part Number 11309-701
2. Or approved equal from 2-post rack manufacturer

N. Vertical Wall Brackets (pair)

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1. Chatsworth - Part Number 10608-701
2. Or approved equal from 2-post rack manufacturer

O. Threaded Ceiling Kit, Cable Runway

1. Chatsworth - Part Number 11310-001
2. Or approved equal from 2-post rack manufacturer

P. Threaded Rod Cover

1. Chatsworth - Part Number 11085-001
2. Or approved equal from 2-post rack manufacturer

Q. Protective End Caps for Cable Runway

1. Chatsworth - Part Number 10642-001
2. Or approved equal from 2-post rack manufacturer

R. End Closing Kit, Cable Runway

1. Chatsworth - Part Number 11700-718
2. Or approved equal from 2-post rack manufacturer

2.013 J-HOOKS / HOOK & LOOP STRAPS

A. J-Hooks

1. Shall be listed as meeting UL 2239 requirements
2. Shall be listed/approved for installation in return-air plenum spaces
3. Shall be designed and equipped with accessories (if needed) to be supported by the following methods:

    a. Threaded rod from structure
    b. Wall-mounted to concrete/CMU walls or wood or metal studs
    c. Beam clamps
    d. Optional “multi-tiered” mounting to bottom of J-hook
    e. Optional Fastener to raised floor pedestal

4. Equipped with retainer or strap over top of J-hook once cables are installed
5. Sized to support quantity of installed cables, plus 25% spare capacity
6. Manufacturer:

    a. Erico – Caddy CAT Links
    b. Panduit – J-Mod Cable Supports
    c. Or Approved Equivalent

B. Hook & Loop Straps

1. Plenum-rated
2. Velcro construction with hook/loop strap
3. Color: black
4. Manufacturer:

    a. Panduit Tak-Ty Plenum Ties
    b. VELCRO ONE-WRAP

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c. Or Approved Equal

C. Grid Wire Clips

1. Caddy 6Z4S WR RD FLANGE CLIP
2. Or Approved Equal

2.014 TELECOM GROUNDING AND BONDING

A. TMGB (Telecommunications Main Grounding Busbar) / PBB (Primary Bonding Busbar)

1. Copper construction
2. Size: per Drawings
3. UL 467 Listed
4. TIA-607 hole pattern (pairs of lugs at 5/8” hole centers and 1” hole centers)
5. Part of kit that includes: busbar, two insulators, two steel stand-off brackets, and mounting accessories
6. Manufacturer:

a. 4” x 12” x 1/4"
   1) Chatsworth 40153-012
   2) Harger GBI14412TMGBKT
   3) Or equal from Hubbell
   4) Or equal from Panduit
   5) Or Approved Equal

b. 4” x 20” x 1/4"
   1) Chatsworth 40153-020
   2) Harger GBI14420TMGBKT
   3) Or equal from Hubbell
   4) Or equal from Panduit
   5) Or Approved Equal

B. TGB (Telecommunications Grounding Busbar) / SBB (Secondary Bonding Busbar)

1. Copper construction
2. Size: per Drawings
3. UL 467 Listed
4. TIA-607 hole pattern (pairs of lugs at 5/8” hole centers and 1” hole centers)
5. Part of kit that includes: busbar, two insulators, two steel stand-off brackets, and mounting accessories
6. Manufacturer:

a. 2” x 12” x 1/4"
   1) Chatsworth 13622-012
   2) Harger GBI14212TGBKT
   3) Or equal from Hubbell
   4) Or equal from Panduit
   5) Or Approved Equal

b. 4” x 12” x 1/4"
   1) Chatsworth 40153-012
   2) Harger GBI14412TMGBKT
   3) Or equal from Hubbell
   4) Or equal from Panduit

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5) Or Approved Equal

C. Two-Hole Lugs

1. UL listed
2. Two-hole, long barrel, electro tin-plated compression lug with inspection port
3. Manufacturer:

   a. Chatsworth 40162-XXX
   b. Harger – GECLB series
   c. Burndy
   d. Or equal from Hubbell
   e. Or Approved Equal

D. Conductors

1. Minimum conductor size shall be #6 AWG; sized based on length per Table on Drawings
2. Green sheath
3. Insulation shall be rated for the environment where it is installed
4. Manufacturer:

   a. Chatsworth
   b. Harger
   c. Hubbell
   d. Or Approved Equal
   e. Or approved conductors listed in Division 26.

E. Conduit Clamps

1. Tinned copper with 1-1/2-inches of contact area.
2. Can be connected to conductors via exothermic connection or standard compression lugs.
3. Manufacturer:

   a. Harger – UPC series
   b. Or equal from Hubbell
   c. Or Approved Equal

F. Cable Tray Clamps

1. Electro-tin plated cast bronze connector
2. UL 467 approved
3. Manufacturer:

   a. Harger - TBCTC
   b. Or equal from Hubbell
   c. Or Approved Equal

G. Cable to Cable Connections

1. T-tap or Exothermic Weld
2. Manufacturer:

   a. Harger RT series (T-tap) or UltraShot Weld Metal (Exothermic Weld)
   b. Or equal from Hubbell

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c. Or Approved Equal

H. Cable to Structural Steel Connections

1. Exothermic Weld – types VA, VD, or VU
2. Manufacturer:

a. Harger – Ultraweld series
b. Or equal from Hubbell
c. Or Approved Equal

2.015 LABELING

A. Cable Labeling

1. For Horizontal Cables and Inside-Plant Backbone Cables

a. Laser/Ink Jet Self Laminating Labels
b. Manufacturer:
1) Panduit – S100X Series
2) Or equal from Brady
3) Or equal from Dymo
4) Or equal from Hellermann Tyton
5) Or Approved Equivalent

2. For Outside-Plant Backbone Cables and Innerduct

a. Self-laminating cable marker tag, tie on (with zip ties)
b. Manufacturer:
1) Fiber Optic – Panduit PST-FO, Mooseline F1-0095
2) Copper – Mooseline F1-0095

B. Rack and Patch Panel Labeling

1. Vinyl cloth label
2. Lettering/numbering text height 3/8” to 1/2"
3. Manufacturer:

a. Brady PTL series
b. Panduit PCL037 series
c. Or Approved Equivalent

2.016 PLYWOOD BACKBOARD

A. Fire-treated, AC grade plywood

B. 8’ tall by 4’ wide by ¾” thick

C. Locations as noted on Drawings

D. Painted with two-coats of fire-retardant white paint (mask out a minimum of one stamp on each piece of plywood used)

2.017 FIRESTOPPING SYSTEMS

A. Fire-Rated Pathway Device (Sleeve)

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1. Steel pathway (sleeve) with integral intumescent firestopping material to facilitate the initial installation - and frequent moves, adds, and changes - of low-voltage voice/data, fiber, video, security, paging, etc cabling.
2. UL System meeting the hourly fire-rating of the wall or floor type
3. Multiple pathways in the same location shall be ganged together.
4. Plenum-rated
5. Manufacturer:

    a. Specified Technologies Inc – EZ Path Fire-Rated Pathway
        1) 2” – Series 22
        2) 3” – Series 33
        3) 4” – Series 44

B. Firestopping for conduit penetrations

1. For metallic conduit or tube to be installed through 1 or 2 hr fire-rated wall or floor.
2. Manufacturer:

    a. Gypsum board stud walls
        1) Specified Technologies - UL System No. W-L-1222 with SpecSeal LCI Sealant

    b. Concrete floors or walls
        1) Specified Technologies – UL System No. C-AJ-1353 with SpecSeal LCI Sealant

C. Firestopping for backboxes in fire- or smoke-rated wall

1. For Communications backboxes to be installed in 1 or 2 hr fire-rated or smoke-rated walls.
2. STC sound rating – 64 or higher (related to specific construction)
3. Shall meet criteria of UL263 and classified for up to hrs as a Wall Opening Protective Material (Category CLIV)
4. Manufacturer:

    a. Specified Technologies – SpecSeal Power Shield

D. Smoke-Rated or Acoustical Sleeves

1. Metallic or non-metallic pathway (sleeve) with integral self-adjusting smoke and sound sealing system to facilitate the initial installation – and frequent moves, ads, and changes – of low-voltage voice/data, fiber, video, security, paging, etch cabling.
2. L Rating – Air Leakage Test Procedure tested per UL1479 without a Fire Test
3. Less than 1.25 cubic feet per minute for 0% fill (cable) capacity
4. Less than 2.5 cubic feet per minute for 1 to 100% fill (cable) capacity
5. Sound Transmission Classification (STC) – 59 or higher (related to specific construction)
6. Plenum-rated
7. Manufacturer:

    a. Specified Technologies Inc – NEZ Pathway

E. Fire-rated Conduit (Circuit Integrity) Wrap

1. Endothermic wrap for EMT and RMC for protection of cable pathways for critical life safety circuits.

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2. Tested to ASTM E1725 for circuit integrity
3. Manufacturer:

   a. Specified Technologies – E-Wrap Endothermic Wrap
   b.

PART 3 - EXECUTION

3.01 CODES, STANDARDS, REGULATIONS

A. American National Standards Institute (ANSI)

B. American Society for Testing and Materials (ASTM)
   1) ASTM B 1 Standard Specification for Hard-Drawn Copper Wire

   2. ASTM B 8 Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
   3. ASTM D 1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
   4. ASTM D 709 Laminated Thermosetting Materials

C. Alliance for Telecommunications Industry Solutions (ATIS)

D. Building Industry Consulting Service International (BICSI)

   1. Telecommunications Distribution Methods Manual 14th Edition
   2. Outside Plant Design Reference Manual 6th Edition
   3. ANSI/BICSI Data Center Design and Implementation Best Practices
   4. ANSI/TIA-568.1-E - Commercial Building Telecommunications Infrastructure Standard
   5. ANSI/TIA-568.2-D - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
   6. ANSI/TIA-568.3-E - Optical Fiber Cabling and Components Standard
   7. ANSI/TIA-569-E - Telecommunications Pathways and Spaces
   8. ANSI/TIA-606-D - Administration Standard for Telecommunications Infrastructure
   9. ANSI/TIA-607-E - Telecommunications Bonding and Grounding (Earthing) for Customer Premises

E. Federal Communications Commission (FCC)

   1. FCC Part 15, Radiated Emissions Limits
   2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network
   3. FCC Part 76, Cable Television Service

F. Insulated Cable Design Consultants Association (ICEA)

   1. ICEA S-87-640 Fiber Optic Outside Plant Communications Cable
   2. ICEA S-98-688 Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors
   3. ICEA S-99-689 Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

G. International Electrotechnical Commission (IEC)

H. Institute of Electrical and Electronics Design Consultants, Inc. (IEEE)

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1. IEEE Standard IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System
2. IEEE Standard 1100 Recommended for practice for Powering and Grounding Sensitive
3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)
4. IEEE C2 Errata INT National Electrical Safety Code
5. IEEE Std 100 The Authoritative Dictionary of IEEE Standards Terms

I. International Organization for Standardization (ISO)

1. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)
2. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises,
3. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration
4. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises
5. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration

J. National Cable Television Association (NCTA)

K. National Electrical Manufacturers Association (NEMA)

1. NEMA C62.61 Gas Tube Surge Arresters on Wire Line Telephone Circuits

L. National Fire Protection Association (NFPA)

1. NFPA-70, National Electrical Code
2. NFPA-75, Protection of Electronic Computer Data Processing Equipment.
3. NFPA-101, Life Safety Code
4. NFPA-297, Guide on Principles and Practices for Telecommunications Systems
5. NFPA-780, Standard for the Installation of Lightning Protection Systems.

M. National Institute Standards and Technology (NIST)

N. Occupational Safety and Health Administration (OSHA)

O. Telecommunications Industry Association (TIA)

1. ANSI/TIA-568.1-E - Commercial Building Telecommunications Infrastructure Standard
2. ANSI/TIA-568.2-D - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
3. ANSI/TIA-568.3-E - Optical Fiber Cabling and Components Standard
4. ANSI/TIA-569-E - Telecommunications Pathways and Spaces
5. ANSI/TIA-606-D - Administration Standard for Telecommunications Infrastructure
6. ANSI/TIA-607-E - Telecommunications Bonding and Grounding (Earthing) for Customer Premises
7. ANSI/TIA-758-B, Customer-Owned Outside Plant Telecommunications Infrastructure Standard.

P. U.S. Department of Agriculture (USDA)

1. RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction
2. RUS Bull 1751F-643 Underground Plant Design

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3. RUS Bull 1751F-815 Electrical Protection of Outside Plant
4. RUS Bull 1753F-201 Acceptance Tests of Telecommunications Plant (PC-4)
5. RUS Bull 1753F-401 Splicing Copper and Fiber Optic Cables (PC-2)
6. RUS Bull 345-65 Shield Bonding Connectors (PE-65)
7. RUS Bull 345-72 Filled Splice Closures (PE-74)
8. RUS Bull 345-83 Gas Tube Surge Arrestors (PE-80)

Q. Underwriters Laboratories, Inc. (UL)

1. UL 510 Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape
2. UL 910 (NFPA 262) Applicable Flame Test

3.02 GENERAL REQUIREMENTS

A. In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Design Consultant in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Design Consultant will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Codes the more stringent shall take precedence.

B. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Design Consultant for direction before proceeding with that part of the work.

C. The Contractor shall be responsible for coordination with other trades to ensure any conflicts or potential conflicts are resolved prior to any work beginning on the project.

D. The Contractor shall install the materials in accordance with these specifications and the manufacturer’s installation guidelines.

E. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Design Consultant. The Contractor shall have written approval from the Architect/Design Consultant for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Design Consultant prior to proceeding with the work, the contractor shall not be reimbursed for the work.

F. The Contractor shall obtain written permission from the Architect/Design Consultant before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

G. Contractor shall perform onsite coordination with the General Contractor, Structural, MEP, and Civil as required to discuss outside plant and inside plant clash detection with other trades.

H. Contractor shall notify the Architect/Design Consultant a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Design Consultant to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

I. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap cable, etc., and dispose of such items on a daily basis and return the site to the original state of

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cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

J. Equipment and materials installed by the Contractor shall be free of defects and damage.

K. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

L. Contractor shall test all cables prior to installation. By failing to perform this testing operation, the Contractor shall accept the cable as compliant and assume all liability for the replacement of the cable at no cost to the Owner should it be found defective at a later date.

M. Contractor shall maintain a set of working specifications, design drawings, and record drawings to be kept on site at all times and shall update the record drawings with any changes on a weekly basis. Record drawings shall be made available for inspection at the request of the Architect/Design Consultant.

N. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

O. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

P. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Design Consultant.

Q. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

R. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

S. Contractor shall be responsible to properly protect information outlets from damage by other trades during construction.

T. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

U. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

3.03 SYSTEM REQUIREMENTS

A. The contractor is responsible for furnishing materials as required to provide a complete and functioning system. Quantities are not noted, so the information may be obtained from the technology drawings.

B. Inter-Building Cable Plant

1. Fiber Optic Cable

a. Singlemode

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1) Contractor shall furnish and install fiber optic cables as indicated on the Drawings
2) Contractor shall install a 10-foot service loop at the ends of each cable to be coiled, mounted, and stored on the wall above the ladder rack.
3) Cables shall be routed utilizing the pathways as indicated in the technology drawings.

2. Fiber Optic Termination

a. Contractor shall terminate all installed fiber optic strands with fusion splice connectors and place into fiber optic enclosures with splice trays as indicated in the technology drawings.
b. Contractor shall furnish fiber optic enclosures and coupler panels for all fiber optic strands and blank panels for all unused slots.

3. Copper Cable

a. High Pair Count Cable
1) The Contractor shall furnish and install copper cables as indicated on the Drawings.
2) The Contractor shall install a 10-foot service loop at the ends of each cable to be coiled, mounted, and stored on the wall above the ladder rack.
3) Cables shall be routed utilizing the pathways as indicated in the technology drawings.

4. High Pair Count Termination

a. Building Entrance Terminals
1) The contractor shall terminate copper cable pairs between the existing communications rooms on contractor furnished and installed building entrance terminals as indicated in the technology drawings.
2) Contractor shall furnish and install all terminals fully populated with surge protection modules.
3) Contractor shall ground and bond all cables and terminals.

b. Wall-mounted Wiring Blocks
1) The Contractor shall furnish and install wall mounted 110 wiring blocks and terminate cable whip from Building Entrance Terminal to this 110-block.
2) The Contractor shall furnish and install tie cables from the protector block/110 block to contractor furnished and install category 5e patch panels.
3) Contractor shall furnish and install tie cables/cross connects from the service provider high pair count copper cable to the owners equipment rack as required.

C. Intra-Building Cable Plant

1. Fiber Optic Cable

a. Singlemode
1) Contractor shall furnish and install plenum rated fiber optic cables as indicated on the technology drawings.
a) Each fiber optic cable shall be installed inside a single cell of the fabric innerduct.

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2) Contractor shall install a 10-foot service loop at the ends of each cable to be coiled, mounted, and stored on the wall above the ladder rack.
3) Cables shall be routed utilizing the pathways as indicated in the technology drawings.

2. Fiber Optic Termination

a. Contractor shall terminate all installed fiber optic strands with fusion splice connectors and place into fiber optic enclosures with splice trays as indicated in the technology drawings.
b. Contractor shall furnish fiber optic enclosures and coupler panels for all fiber optic strands and blank panels for all unused slots.

3. Copper Cable

a. High Pair Count
1) The Contractor shall furnish and install copper cables as indicated on the Drawings.
2) The Contractor shall install a 10-foot service loop at the ends of each cable to be coiled, mounted, and stored on the wall above the ladder rack.
3) Cables shall be routed utilizing the pathways as indicated in the technology drawings.

4. High Pair Count Termination

a. Wall-mounted Wiring Blocks
1) The Contractor shall furnish and install wall-mounted 110-blocks to support all copper backbone pairs. Indicate proposed location on Shop Drawings.

D. Horizontal Cable

1. No horizontal cable shall be longer than two hundred ninety-five (295) feet. If any station cable will be longer than two hundred ninety-five (295) feet, Contractor shall stop installation of the cable and immediately notify Architect/Design Consultant in writing. If Contractor fails to notify the Architect/Design Consultant in writing, Contractor shall replace cable at no cost to the Owner.
2. The Contractor shall furnish and install horizontal cables within each Technology Region from the respective ER or TR to each outlet location as indicated in the technology drawings.
3. The Contractor shall install a 10-foot service loop to be coiled, mounted, and stored above the ladder rack in each respective Equipment Room or Telecommunications Room.
4. The Contractor shall provide a 2-foot service loop coiled and supported directly above the workstation outlet.

E. Horizontal Cable Termination

1. Contractor shall terminate cables as defined by the ANSI/TIA 568-D Commercial Building Wiring Standard with the EIA-568B sequence.
2. Workstations

a. Contractor shall furnish and install modular jacks to terminate UTP horizontal cables.
b. Contractor shall furnish and install faceplates, systems furniture faceplates, or surface-mount boxes to house modular jacks as indicated in the technology drawings.

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1) Any unused faceplate positions shall have the appropriate number and color of blanks installed.

3. Equipment Rooms / Telecommunications Rooms

a. Horizontal Cable for Data
1) Contractor shall furnish and install patch panels and horizontal cable managers to terminate horizontal data cables as indicated in the technology drawings.
2) The Contractor shall provide and install separate modular patch panels for the cabling supporting the following devices:
a) Network Access (Blue cabling and jacks)
b) Security Camera Access (Orange cabling and jacks)
c) Wireless Access (Yellow cabling and jacks)

b. Horizontal Cable requiring lightning protection
1) Contractor shall furnish and install lightning protection on both ends of any cables on the exterior of the building as indicated in the technology drawings.
2) All lightning protection shall be installed per manufacturer's instructions including but not limited to placement and bonding requirements.

F. Patch Cables

1. Fiber

a. Equipment Rooms / Telecommunications Room
1) The Contractor shall furnish and store (1) patch cable in original manufacturer packaging for 75% of the strands terminated per Equipment Room / Telecommunications Room:
a) 100% of the patch cables shall be (2) meters in length and stored in the applicable Equipment Room / Telecommunications Room

2. Copper

a. Workstations
1) The Contractor shall furnish and store (1) patch cable in original manufacturer packaging for each cable terminated.
2) 100% of the patch cables shall be (15) feet in length and stored in the applicable Equipment Room / Telecommunications Room.

b. Equipment Rooms / Telecommunications Rooms
1) The Contractor shall furnish and store (1) patch cable in original manufacturer packaging for each cable terminated per Equipment Room / Telecommunications Room:
2) 100% of the patch cables shall be (length TBD) foot in length and stored in the applicable Equipment Room / Telecommunications Room

G. Cable Support

1. All cables shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc. as indicated in the technology drawings.
2. When cables leave the main pathway systems as indicated on the technology drawings, they shall be installed and supported in Contractor furnished and installed j-hooks or adjustable cable supports.

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3. No cable pathway shall exceed 40% fill ratio.
4. The contractor shall furnish a separate j-hook or adjustable cable support pathway for each cable type (data, paging/clock, and security).
5. J-hooks and adjustable cable supports shall be installed no more than five-feet (5') apart on center, using only manufacturer-approved installation methods and hardware.
6. J-hooks and adjustable cable supports shall be installed no higher than 3-feet above the accessible ceiling to allow for ease of access for future moves, adds and changes
7. Do not utilize ceiling grid support wire; support j-hooks via wall, structure, or threaded rod support to structure.
8. J-hooks shall be furnished with closure clips.
9. Maximum sag between supports shall not exceed twelve-inches (12").
10. Contractor shall establish j-hook and adjustable cable supports pathways and shall coordinate pathways with all other disciplines. Under no-circumstances shall these pathways be used to support other low-voltage applications not included in this specification.
11. Contractor shall provide and install horizontal cabling in unison with the construction process and prior to the gypsum ceiling being installed.
12. UNDER NO CIRCUMSTANCES SHALL ZIP TIES BE USED ON ANY HORIZONTAL CABLING.
13. Cable Dressing

    a. No nylon cable ties shall be used at any time during the installation of the cable.
    b. Above Ceiling
        1) Contractor shall furnish and install plenum-rated hook & loop straps in plenum-rated airspaces.
            a) The Contractor shall install no more than (1) hook & loop strap between each j-hook or saddle strap or at service loop locations.

    c. Equipment Rooms / Telecommunications Rooms
        1) The Contractor shall bundle all visible cables by type (blue Cat 6 for data, blue Cat 6A for WAPs, yellow for security, white for paging, etc) with Contractor furnished and installed hook & loop straps.
            a) Hook & loop straps shall be installed twenty-four (24) inches apart on center.

H. Equipment Rooms / Telecommunications Room Build-Out

1. Plywood

    a. The Contractor shall furnish and install 8' H x 4' W x ¾" D sheets of AC grade fire-rated plywood as indicated in the technology drawings.
    b. The Contractor shall mount all plywood vertically starting at 24" AFF.
    c. The Contractor shall cover the plywood with two (2) coats of Contractor furnished white fire-retardant paint leaving exposed (1) fire rating stamp per sheet.

2. Cable Runway (Ladder Type)

    a. Contractor shall furnish and install cable runway using manufacturer-approved hardware and installation methods as indicated in the technology drawings.
    b. Contractor shall furnish and install vertical sections of cable runway using manufacturer-approved hardware and installation methods to provide transition and support where cables enter or exit the room using a vertical pathway.

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c. Contractor shall furnish and install radius drops cross member and stringers above each rack using manufacturer-approved hardware and installation methods where cables exit the horizontal section of the ladder rack.
d. Contractor shall ground and bond each cable runway section to the next utilizing ground straps and ensure metal-to-metal contact.

3. Equipment Racks and Cabinets

a. Contractor shall furnish and install equipment racks with vertical management using manufacturer approved hardware and installation methods as indicated in the technology drawings.
b. Contractor shall secure relay racks to the concrete floor utilizing expandable concrete anchors.
c. Contractor shall secure the equipment racks to the cable runway using cable runway elevation kits and manufacturer approved hardware and installation methods.
d. Contractor shall bolt all equipment racks and vertical cable managers together.
e. Contractor shall individually ground and bond each equipment rack and ensure metal-to-metal contact.

4. Patch Panels

a. Horizontal Cabling patch Panels shall be installed as indicated in the Technology Drawings.

I. Grounding and Bonding

1. General Requirements:

a. Ensure metal-to-metal contact for all terminations.
b. All materials shall be UL Listed.
c. Cable-to-cable connections and cable-to-building steel connections shall be exothermic welds. All other connections shall be made with UL Listed compression 2-hole lugs with anti-oxidation compound, utilizing both lug openings.
d. Only one lug shall occupy a hole on the busbar. No stacking lugs or “double lugging” shall be permitted.
e. Bonding conductors shall be sized based on length per the table on the Drawings; minimum size #6 AWG and maximum size 750kcmil.
f. For Communications Rooms / Data Centers with a raised floor, provide a supplementary bonding grid (SGB) below the raised floor comprised of the following:
    1) Bare copper conductor around the perimeter of the room
    2) 12”x4” TGB/SBB, bonded to two points of the perimeter conductor and to the TGB/SBB above the access floor
    3) Bond all piping and conduit entering raised floor at the perimeter.
    4) Bond floor pedestal to Computer Room Air Conditioning Unit (if located in Communications Room)
    5) Bare copper conductor between every four stringers, running the length/width of the room in both directions; bond to every fourth pedestal in both directions and to perimeter bonding conductor.
    6) Bond floor pedestal to Power Distribution Unit feeder conduit below raised floor.

2. Telecom Bonding System shared with Electrical Ground System – Compliant with BICSI TDMM

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a. For a building without structural steel, Telecommunications Bonding Backbone is not required. The TMGB/PBB shall be bonded to the Electrical Ground System via a Bonding Conductor for Telecommunications. TGB/SBB shall be bonded to the grounding busbar of the serving electrical panelboard. Bonding conductor routing shall be indicated on Record Drawings.
b. Provide label above TGB/SBB shall indicated name of electrical panelboard and the room it is located. Indicate routing on pre-construction Shop Drawings, and update with final installed routing as part of As-Built Drawings.

3. Main Communication Room (MDF / Server Room) requirements

a. Install TMGB/PBB at 84-inches above finished floor.
b. Bonding Conductor for Telecommunications (BCT)
   1) Division 26 Contractor shall provide Bonding Conductor for Telecommunications from the Electrical Ground System to the TMGB/PBB in the MDF Room.
   2) BCT conductor size shall be sized based on length per the table on the Drawings and shall be no smaller than the largest TBB conductor. If installed underground, install in dedicated 2-inch diameter conduit.

c. Provide bonding conductors to the following equipment within the Communication Room (where available/installed):
   1) Structural steel or support beams located within the room.
   2) If electrical distribution panelboard serving the Communications Room is located within the Communications Room, bond TGB/SBB to ground bus of the panelboard.
   3) Overhead ladder rack
   4) Equipment racks, cabinets, and enclosures
   5) Surge protectors / building entrance terminals
   6) Exposed cable shields
   7) Continuous metallic conduits for low-voltage cabling that stub into the Communication Room
   8) Any additional equipment or pathways where bonding/grounding is recommended by the equipment manufacturer or the referenced standards (TIA 607 and NECA/BICSI 607).

4. Secondary Communication Rooms (IDFs / Data Rooms)

a. Install TGB/SBB at 84-inches above finished floor.
b. Provide bonding conductors to the following equipment within the Communication Room (where available/installed):
   1) Structural steel or support beams located within the room.
   2) If electrical distribution panelboard serving the Communications Room is located within the Communications Room, bond TGB/SBB to ground bus of the panelboard.
   3) Overhead ladder rack
   4) Cable trays in corridor
   5) Equipment racks, cabinets, and enclosures
   6) Surge protectors / building entrance terminals
   7) Exposed cable shields
   8) Continuous metallic conduits for low-voltage cabling that stub into the Communication Room

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9) Any additional equipment or pathways where bonding/grounding is recommended by the equipment manufacturer or the referenced standards (TIA 607 and NECA/BICSI 607).

J. Wire-mesh cable tray

1. Coordinate with all other disciplines to ensure cable tray routing and installation is coordinated with other systems.
2. Coordination with all other disciplines to ensure the 12-inch clearance above the tray is maintained.
3. Any elevation changes shall have radius drops installed to support the cables properly.
4. Install cable trays parallel with or at right angles to ceilings, walls, and structural members. Utilize 45-degree off-sets/routing to change elevation and horizontal routing.
5. Provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.
6. Where cable trays encounter a non-fire-, smoke-, or acoustically-rated wall, cut opening through wall to facilitate continuous cable tray installation through wall.
7. Where cable trays encounter fire, smoke, or acoustically-rated wall, stop cable tray and provide Fire-or Smoke-Rated Pathway Devices. Provide number of devices to match square-inch capacity of cable tray. Devices shall be ganged together with manufacturer-specific accessory.
8. Ground and bond cable tray in accordance with NFPA 70, TIA-607, and NECA/BICSI-607.

    a. Bond cable tray to the Telecom Ground Bar in each Communications Rooms. Utilize #6 AWG conductor for lengths up 13 feet, a #4 AWG conductor for lengths of 14 to 20 feet, and a #3 AWG conductor for lengths of 21 to 26 feet. Refer to TIA 607 standard for conductor size requirements for lengths longer than 26 feet.
    b. Provide ground lugs between each section of cable tray to ensure electrical continuity of cable tray installation. Where cable tray sections are separated by conduit or firestopping sleeves, provide #6 AWG bonding jumper between cable tray sections.

9. Cable Tray Supports

    a. Cable tray shall be supported by a trapeze or wall support brackets. No center support brackets shall be allowed.
    b. A minimum of 3/8-inch all-thread shall be used for trapeze supports.
    c. Support in accordance with manufacturer recommendations but at not more than 10 foot intervals.
    d. Cable tray shall be no less than 3-inches above a lay-in ceiling.
    e. Cable tray shall be rigidly supported and level.
    f. All-thread shall be covered from the attachment to the trapeze system to 3-inches above the tray to protect the cables from being chaffed.
    g. All supports shall attach to structure or a rigid surface such as a plywood backer in a sheet rock wall.
    h. Supports shall not be shared with any other discipline.

K. Firestopping

1. Fire-Rated Pathway Devices

    a. Provide Fire-Rated Pathway Device(s) wherever Communications cabling routed above accessible ceiling needs to be routed through a fire-rated wall. Quantity and

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size of devices shall be sized per manufacturer's published cable fill counts, leaving 25% spare capacity.

b. Coordinate quantity, size and locations with other Division 27 Subcontractors and indicate quantity, size, location, product make and model number, and UL System number on Pre-Construction Shop Drawings.

c. Coordinate quantity, size and locations with other Division 27 Subcontractors and indicate quantity, size, location, product make and model number, and UL System number on Pre-Construction Shop Drawings.

d. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

2. Firestopping for Conduits

a. Provide firestopping components as part of a UL System for all conduit penetrations through fire-rated and smoke-rated walls and floors.

b. Coordinate locations and UL System with other Division 27 Subcontractors and indicate locations and UL System number on Pre-Construction Shop Drawings.

c. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

3. Firestopping for Backboxes

a. Provide firestopping component(s) as part of a UL tested/approved solution for backboxes located in fire-rated and smoke-rated walls.

b. Coordinate locations with other Division 27 Subcontractors and indicate locations on Pre-Construction Shop Drawings.

4. Smoke-Rated / Acoustical Pathway Device

a. Provide Smoke-Rated Pathway Device(s) wherever Communications cabling routed above accessible ceiling needs to be routed through a smoke-rated wall or through a wall of a Noise Critical Room.

b. Quantity and size of devices shall be sized per manufacturer's published cable fill counts, leaving 40% spare capacity.

c. Coordinate quantity, size and locations with other Division 27 Subcontractors and indicate quantity, size, location, product make and model number, and UL System number on Pre-Construction Shop Drawings.

d. For smoke-rated partitions: Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

5. Fire-rated Conduit (Circuit Integrity) Wrap

a. Provide Fire-rated Conduit (Circuit Integrity) Wrap for certain Communications conduits for the following systems:
   1) Section 275129 Two-Way Communications System
   2) Section 275319 Emergency Responder Radio Coverage (ERRC) DAS

b. Coordinate conduit size and lengths requiring wrap with Subcontractors of those sections prior to Bid and include cost to provide that wrap in the Bid.

L. System Labeling

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1. Contractor shall verify room numbers and confirm the final room numbering scheme prior to generating any labels.
2. Horizontal Cables shall be labeled within (12) inches from the termination point inside the Equipment Room/Telecommunications Rooms.
3. Horizontal Cables shall be labeled within (6) inches from the termination point at the workstation end.
4. Backbone Fiber and Copper Cables shall be labeled within (12) inches of the visible end of the jacket and at each pull point location. If passing through an IDF it will be labeled when entering and leaving that IDF.
5. Fiber Innerduct shall be labeled within (12) inches of the point of entry of the fiber optic enclosure and at each pull point location. If passing through an IDF it will be labeled when entering and leaving that IDF.
6. Bonding conductors shall be labeled within (12) inches from their termination point.
7. Cables shall be labeled identically at both ends.
8. Equipment Racks

    a. Equipment racks in each Equipment/Telecommunication Room shall be labeled in sequential numeric order.
        1) Labels shall be centered on the top front of the equipment rack.

9. Cabinets

    a. Cabinets in each Equipment/Telecommunication Room shall be labeled in sequential numeric order.
        1) Labels shall be centered on the top front of the Cabinet.

10. Fiber Optic Enclosures

    a. Fiber optic enclosures shall be labeled alpha-numeric starting with the 1st fiber optic enclosure in the top of the 1st equipment rack.
    b. A label for each terminated strand shall be securely placed inside each fiber optic enclosure.

11. Backbone Cable

    a. Fiber Optic Cable
        1) Fiber optic backbone cable labels shall contain the cable origin room number, the cable destination room number, fiber strand numbers, and type (i.e. B126-A118/001-012MM).
        2) Fiber optic couplers panels in fiber enclosures shall be labeled at each end by strand denoting building code, Equipment Room and/or Telecommunications Room, enclosure number, and strand number to and from respectively (i.e. B126/01/01-12 – A118/01/01-12).

    b. High Pair Count Copper Cable
        1) For high pair count copper backbone cables, the label scheme shall contain, cable origin room number, the cable destination room number, and cable pairs (i.e. B126-A118/001-025).

12. Horizontal Cable

    a. Inside Equipment Rooms

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1) Horizontal cables shall be labeled at each end with the destination end and origin room number, patch panel number, and port number. (i.e. B126-B127-A01).
2) Patch panels in each closet shall be labeled sequentially starting with the first Patch Panel in the top of the first relay rack (A, B, C, D, E, etc.).
3) All patch panels will indicate the room number along with the patch panel port designation. The labels shall be mechanical labels that are neatly printed with uniform font and evenly spaced across the patch panel. Room numbers will be in sequential order throughout the panels as indicated on the drawings.
4) 110-type blocks shall contain the destination room number, pair numbers, and binder pair number under each pair termination. (example)
   a) 110-type block labels shall be printed on product-specific label strips and placed into label holders.

13. Workstation Faceplates

    a. Cables and wall plates shall be labeled denoting origin, Equipment Room/Telecommunications Room Number, Patch Panel, 110-type termination block, and Port Number. (i.e. B127-A01).

14. TMGB/PBB and TGB/SBB

    a. TMGB/PBB and TGB/SBB shall be labeled with a unique identifier (i.e. TMGB/PBB-B126, TGB/SBB-A118).

15. Bonding Conductors

    a. The following conductors shall be labeled at each end with the destination end and origin room number (i.e. B126 – IDFA118).
       1) Bonding Conductor for Telecommunications
       2) Telecommunications Bonding Backbone
       3) Grounding Equalizer

3.04 TESTING REQUIREMENTS

A. Fiber Optic Cable

1. Installed strands shall be tested and certified in accordance with industry standards.
2. Only Manufacturer Certified Technicians shall perform testing.
3. The Contractor shall test and certify all fiber optic cable strands with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.
4. The Contractor shall provide calibration results from the manufacturer showing the current calibration of the testers.
5. The Contractor shall notify the Architect/Design Consultant a minimum of five (5) days in advance to observe cable testing.
6. The Architect/Design Consultant may randomly select 5% of the installed strands for test verification purposes. The Contractor shall re-test these strands in the presence of the Architect/Design Consultant and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed strands at no cost to the Owner.

B. Copper Backbone Cable

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1. Installed pairs shall be tested and certified in accordance with industry standards.
2. Only Manufacturer Certified Technicians shall perform testing.
3. The Contractor shall test and certify all copper pairs with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.
4. The Contractor shall provide calibration results from the manufacturer showing the current calibration of the testers.
5. The Contractor shall notify the Architect/Design Consultant a minimum of five (5) days in advance to observe cable testing.
6. The Architect/Design Consultant may randomly select 5% of the installed pairs for test verification purposes. The Contractor shall re-test these pairs in the presence of the Architect/Design Consultant and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed pairs at no cost to the Owner.

C. Category 6 and 6A UTP Cable

1. Cable links shall be tested in accordance with industry standards.
2. Only Manufacturer Certified Technicians shall perform testing.
3. The Contractor shall test and certify the structured cable system with approved field tester(s) that are within their calibration period. The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s) that are not within their calibration period.
4. No Fail or *Pass results will be accepted.
5. The Contractor shall notify the Architect/Design Consultant a minimum of five (5) days in advance to observe field testing.
6. The Architect/Design Consultant may randomly select 5% of the installed links for test verification purposes. The Contractor shall re-test these links in the presence of the Architect/Design Consultant and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously-submitted test results, all testing shall be declared a failure and the Contractor shall re-test 100% of the installed links at no cost to the Owner.

D. Grounding and Bonding

1. Main Building Ground

   a. Coordinate with electrical contractor and provide a copy of their test results for the main building ground. The results shall be below 25 Ohms.

2. Two-Point Ground/Continuity Testing

   a. Prior to the two-point ground testing, a visual inspection shall be performed to verify that the bonding and grounding system is installed according to the drawings and specifications and in compliance with the TIA-607-D Standard.
   b. All testing shall be conducted prior to any active equipment is installed.
   c. The Contractor shall use an earth ground resistance tester that is configured for a continuity test. This is also known as a two-point tester or a “dead earth” test.
   d. Prior to the two-point continuity test conduct a voltage test to ensure there is no stray voltage in the system.
   e. The testing shall include but is not limited to the following points:
      1) Building electrical grounding electrode and the TMGB/PBB.

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2) TGMB/PBB TGB/SBB to electrical ground in ER/TR.
3) TGMB/PBB TGB/SBB to the building steel (if present).
4) TMGB/PBB to each TGB/SBB.
5) Building steel (if present) to the electrical ground.

f. Per the TIA-607-D, the maximum value for resistance between any point in the telecommunications bonding and grounding system and the building's electrical grounding electrode system is 100 milliohms. In the case of long TBB and Grounding Equalizer conductor runs, the resistance of the conductor must be factored into the total resistance. For example: 1 km of a No. 3/0 conductor has a resistance of 0.2028 ohms. (0.06180 ohms per 1000 ft.)

g. The Contractor shall notify the Architect/Design Consultant a minimum of five (5) days in advance to observe field testing.

3.05 PROJECT CLOSEOUT DOCUMENTATION

A. As-Built Drawings

1. Drawings shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect/Design Consultant.
2. Provide Drawings depicting the condition of the structured cabling system as installed.
3. As-Built drawings shall be produced in AutoCAD 2017 or higher and provided in hardcopy and electronically in .dwg and PDF format.
4. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect/Design Consultant.
5. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of all equipment room/telecommunication room layouts, wall elevations, equipment rack elevations, ladder racks, cable tray, sleeves, backbone and horizontal cable pathways, workstation locations, and labeling scheme.
6. A laminated copy of the telecommunications room service region with the labeled work areas outlet shall be provided and hung in each telecommunications room. Drawing size will be 30"x42".

B. Test Documentation

1. Test documentation shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until these test results are received and approved by the Architect/Design Consultant.
2. Provide test documentation for the structured cabling system as installed.
3. Test results shall be provided in original electronic format (i.e., manufacturer's proprietary testing software along with applicable reader software) and PDF electronic format.
4. Test documentation shall be bound, sectioned, and tabbed in the following sequence as applicable:
    a) Tester(s) Calibration Certificate(s)
    b) Inter-Building Backbone Fiber Optic Cable
    c) Inter-Building Backbone Copper Cable
    d) Intra-Building Backbone Fiber Optic Cable
    e) Intra-Building Backbone Count Copper
    f) Horizontal Category 3 Cable
    g) Horizontal Category 5e Cable
    h) Horizontal Category 6 Cable
    i) Horizontal Category 6A Cable
    j) Main Building Ground
    k) Two-Point Ground/Continuity Test

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C. Manufacturer's Performance Certification

1. Certificate shall be provided to the Architect/Design Consultant at the time of final system acceptance. Final payment will not be recommended until the certificate of certification is received and approved by the Architect/Design Consultant.

    a. The manufacturer of the solution shall furnish a performance certification as per the specifications starting at final system acceptance.
    b. One original and two copies of the Manufacturer's Certificate shall be provided.

D. Manufacturer's Product Warranty

1. Certificate of product warranty shall be provided to the Architect/Design Consultant at the time of final system acceptance. Final payment will not be recommended until this certificate of product warranty is received and approved by the Architect/Design Consultant.

    a. The manufacturer of the solution shall furnish a product warranty as per the specifications starting at final system acceptance.
    b. One original and two copies of the Manufacturer's product warranty shall be provided.

E. Contactor's Statement of Warranty

1. Statement of warranty shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Design Consultant.

    a. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.
    b. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e. Contractor name, Point of Contact, address, phone number and email address) and start and end date for warranty call outs.

F.

G.

END OF SECTION

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SECTION 274116
INTEGRATED AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED WORK

A. Division 26 – Grounding and Bonding

B. Division 26 – Electrical Hangers and Supports

C. Division 27 – Structured Cabling System

1.2 GENERAL

A. This section identifies the requirements, technical design, and specifications for the audiovisual systems at Turner Elementary School, located in Willis, Texas (“Owner”). The audiovisual systems as specified are industry standard and may include (but not be limited to) the following: interactive flat panel display(s), flat panel display mounting hardware, multimedia input connections, and audiovisual hardware as specified.

B. Contractor shall include materials, equipment, and labor necessary to provide a complete and functional audiovisual system regardless of any items not listed or described in this specification or the associated drawings.

C. Contractor shall verify presence and proper operation of all OFE prior to beginning work.

D. It is strongly recommended that each prospective Contractor perform a site visit to determine any site conditions that may impact the installed system cost prior to submitting a bid and/or submittals. Failure to perform a site visit does not release the Contractor from responsibility for any existing conditions.

E. This project requires advanced configuration and programming of Control Systems and Integrated Video Conferencing System. Contractor will be required to have a background in the programming of these and all manufacturer required certifications.

1.3 QUALITY ASSURANCE

A. 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.

B. All individuals installing the audiovisual 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.

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C. The proposing contractor and the installing contractor must be the same company for the entire scope of work for audiovisual. No subcontractor to the proposing audiovisual contractor will be allowed for any portion of the audiovisual scope of work.

D. The Audiovisual System Installer shall meet all applicable regulations of the State of Texas and Department of Labor insofar as they apply to this type of system. The bidder shall be a firm normally employed in the audiovisual industry and shall provide a reference list of (5) projects of equivalent size or larger. Contractor shall provide the following information for each project: project name, project location, project completion date (Month/Year), brief description of project, major components, and client point of contact name/information. Reference projects must be from proposed office location for the project.

E. The bidder shall have an authorized office within (75) miles of the project's location technicians and service capabilities. The owner reserves the right to perform an on-site inspection.

F. The bidder shall have technicians available for service with a minimum of (1) day response time for service.

G. The bidder must produce a letter from the manufacturer guaranteeing the delivery of all the equipment outlined in the specification herein.

H. Installing contractor shall have an InfoComm / AVIXA CTS-D certification overseeing the submittal and record drawings of the audiovisual systems.

I. Installing contractor shall have an InfoComm / AVIXA CTS-I certification overseeing the installation of the audiovisual systems.

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. Latest applicable National Electrical Code (As designated by the project).

B. Additional References:

1. ANSI/TIA-568.1-E - Commercial Building Telecommunications Infrastructure Standard
2. ANSI/TIA-568.2-D - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
3. ANSI/TIA-568.3-E - Optical Fiber Cabling and Components Standard
4. ANSI/TIA-569-E - Telecommunications Pathways and Spaces
5. ANSI/TIA-606-D - Administration Standard for Telecommunications Infrastructure
6. ANSI/TIA-607-E - Telecommunications Bonding and Grounding (Earthing) for Customer Premises

C. Governing Codes and Conflicts

1. 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

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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 SUBMITTAL REQUIREMENTS

A. Contractor shall provide the following submittals required for the project.

1. Part 1- Qualifications and Product Data
2. Part 2- Submittal Drawings
3. Part 3- Audiovisual Control System Submittal

B. Contractor shall provide the following documentation as part of the submittal package. Partial submittals will not be accepted unless project needs on an expedited request for an individual product (Example, lead time issues, back boxes, etc.).

C. Part 1 Qualifications and Product Data may be submitted prior to Part 2 and Part 3 completion.

D. Part 1- Qualifications and Product Data

1. Provide all documentation confirming requirements noted in section 1.03 QUALITY ASSURANCE.
2. Manufacturer Product Certifications (Project Specific) for Company, Installers and Programmers including Subcontractors. (Crestron, Extron, Biamp, etc.)
3. Line by line conformance review of the specifications. Any variance from the specification will be annotated and an explanation given.
4. Itemized list of all equipment and materials. Any substitution or approved equal products must be clearly noted in submittal.
5. Itemized list of all equipment and materials including any substitutions that were approved and any proposal discrepancies. This list shall contain quantity, manufacturer, part number and description to provide a complete and functional audiovisual system.
6. Manufacturer product specification sheets for all audiovisual products and cabling.
7. For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted.
8. Submit specification sheets only. Do not submit a user or operator’s manual in lieu of a specification sheet. If a specification sheet is not available from the manufacturer, submit a catalog page or the specification appendix (only) from the operation manual. PDF of the specification section of the product from the manufacturer’s website is acceptable.
9. Provide a Warranty Statement that contains specific details on the contractors’ Warranty being proposed for this scope of work. Base warranty for project shall be (1) year from system acceptance.
10. Contractor shall not order, purchase, or install any equipment until Product Data submittal has been accepted in writing by the Owner/Consultant.

E. Part 2 - Submittal Drawings

1. Submittal drawings shall include system line diagrams, floor plans (include projector installed distance from screen with dimensioned distance), rack elevations, and/or detail drawings as required. Shop drawings shall be submitted electronically in pdf format for a 30”x42” paper size. Shop drawings shall not contain copies of or snippets of or depictions of Combs Consulting Group’s drawings.

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2. Submittal drawing shall provide floor plans with audiovisual devices located and identified.
3. Submittal drawings shall provide major cabling pathways and termination locations noted on drawings.
4. Submittal drawings shall provide point-to-point wiring diagrams for devices and control as indicated on COMBS Signal Flow drawing for all components.
5. Submittal drawings shall include cabling and device labeling scheme.
6. Shop drawings shall be provided clearly depicting any proposed modification to the project drawings. Any modifications shall be highlighted on the shop drawings.
7. Submittal drawings shall be updated as project change requests and field condition changes are completed. Current submittal drawings shall be utilized for Record Drawing or As-Built drawings.
8. Contractor shall maintain a set of submittal / shop drawings on site at all times and shall update the shop drawings on a weekly basis. Consultant drawings and specifications shall be made available during the installation of the project for reference. Both sets of drawings are the responsibility of the Contractor to provide and maintain. Drawings shall be made available for inspection at the request of the Owner / Consultant.

F. Part -3 Audiovisual Control System Submittal

1. Contractor shall be required to set up meeting with owner and general contractor to review the space, AV functions, control panel layout preferences, pre-set preferences, and room requirements for programming.
2. Contractor shall provide final control panel layouts as part of the submittal for final approval.
3. Provide the control system submittal prior to initiating any substantial programming work and/or production of custom produced keys/labeling. Do not proceed with custom work until the proposed work product is approved in writing.
4. Proposed touch panel/keypad control layouts for each room/panel.
5. Initial touch panel/keypad control layouts will be required for each room/panel as part of the submission.
6. Contractor will design and modify control interface(s) based on Owner feedback. Contractor shall participate in an initial control system kick-off meeting along with progress meetings to review control system layout and design with the owner to ensure the control system fully meets the Owner’s needs and expectations.
7. Contractor shall fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology and final results.
8. Contractor will also be expected to make reasonable adjustments to completed control systems based on Owner feedback once system is in use.
9. Once initial system programming is implemented, allow owner a (2) month period to utilize the system and make comments. Revisions to the programming shall be at no cost to the owner.
10. After initial evaluation period coordinate with Owner, record Owner’s feedback and provide adjustments as requested.

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PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Owner/Consultant will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

C. Proposed equivalent items must be approved in writing by the Owner/Consultant prior to submitting a bid. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer’s specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer’s part number.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices and intended application.

G. All wiring, equipment and installation materials shall be new and of the highest quality.

H. Labels on all wiring, materials and equipment must indicate a nationally recognized testing laboratory.

I. All new equipment shall be received, stored, and staged at the Contractor’s facility until delivered and installed. Contractor shall store all materials and equipment in accordance with manufacturers' instructions in a weather-tight, secure enclosure. All equipment shall be protected from dust, debris and environmental contamination. Contractor shall be responsible for safety and security of all Contractor furnished equipment and OFE until project close-out.

2.2 AUDIOVISUAL DISTRIBUTION AND CONTROL

A. Provide turn-key AV distribution and control for each room indicated on drawings.

B. Signal Flow Diagrams on the Drawings include expected main components. Provide additional components, accessories, and associated programming as needed to provide a fully functional Audiovisual System for each Room Type that operates as intended for all specified components.

C. Provide, Install, and Program all PoE networking switch gear required for all audiovisual equipment. All audiovisual devices requiring PoE network cabling shall be patched to the contractor provided network switch as required.

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D. Network switch and programming for audiovisual switch shall be required to meet the manufacturer's recommendations and requirements for the IP based communications system for manufacturer such as Crestron /QSC controls system and QSC audio system.

E. Provide a complete and tested integrated audiovisual system.

F. Functionally complete audiovisual system shall be provided in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result shall be provided whether specifically called for, at no additional cost to Owner.

G. Contractor shall provide the following submittals required for the project.

1. Part 1- Qualifications and Product Data
2. Part 2- Submittal Drawings
3. Part 3- Audiovisual Control System Submittal

H. Audiovisual Control Systems

2.3 TYPICAL CLASSROOM SYSTEM

A. Room Functionality and Design Intent

1. These systems shall support presentation and instruction.
2. Each classroom will be equipped with a wall-mounted, flat panel display and a wall-mounted multimedia connection plate located at the instructor position.
3. Each flat panel display will be furnished with a wall mount and power and data terminated in an AV Wall Box.

B. Multimedia Devices

1. Wall Mounted HDMI Connector Plate

a. Reference drawings for display designation and location.
b. Wall Plate shall be constructed of 1/8-inch brushed aluminum.
c. Coordinate color and finish with architect.
d. Provide and install Wall Plate, HDMI Connection, and cabling to Interactive Flat Panel Display 'IFP75.'
e. Provide and install AV cabling, single gang brush plate transition, and single gang mud ring.
f. Approved Manufacturer:
   1) 'MM1' – Legrand CG39702 HDMI and USB Pass Through Wall Plate - White Series
   2) Approved Equal.

C. Video Displays

1. Interactive Flat Panel Displays

a. Reference drawing for display designation and location.

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b. 75” diagonal size.
c. Owner Furnished; Contractor Installed
d. Basis of Design / Approved Manufacturer:
    1) ‘IFP75’ - Promethean ActivPanel10 75” 4k
    2) Approved Equal

2. Low Profile Display Mount

a. Provide low profile mount for displays with no audiovisual wall box.
b. All display mounts and displays shall be within ADA requirements.
c. Approved Manufacturer:
    1) Promethean AP-WALLMNT-2
    2) Approved equal.

2.4 BREAKOUT ROOMS

A. Room Functionality and Design Intent

1. These systems shall support presentation and instruction.
2. Each classroom will be equipped with a wall-mounted, flat panel display and a wall-mounted multimedia connection plate located at the instructor position.
3. Each flat panel display will be furnished with a wall mount and power and data terminated in an AV Wall Box.

B. Multimedia Devices

1. Wall Mounted HDMI Connector Plate

a. Reference drawings for display designation and location.
b. Wall Plate shall be constructed of 1/8-inch brushed aluminum.
c. Coordinate color and finish with architect.
d. Provide and install Wall Plate, HDMI Connection, and cabling to Interactive Flat Panel ‘IFP75.’
e. Provide and install AV cabling, single gang brush plate transition, and single gang mud ring.
f. Approved Manufacturer:
    1) ‘MM1’ – Legrand CG39702 HDMI and USB Pass Through Wall Plate - White Series
    2) Approved Equal.

C. Video Displays

1. Interactive Flat Panel Displays

a. Reference drawing for display designation and location.
b. 75” diagonal size.
c. Owner Furnished; Contractor Installed
d. Basis of Design / Approved Manufacturer:
    1) ‘IFP75’ - Promethean ActivPanel10 75” 4k
    2) Approved Equal

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2. Low Profile Display Mount

    a. Provide low profile mount for displays with no audiovisual wall box.
    b. All display mounts and displays shall be within ADA requirements.
    c. Approved Manufacturer:
        1) Promethean AP-WALLMNT-2
        2) Approved equal.

2.5 CABLING AND CONNECTORS

A. All indoor cabling shall be plenum rated. All outdoor cabling shall be outdoor rated and direct burial rated when in contact with grade or within conduit in contact with grade. Coordinate all cable colors with Owner/Consultant prior to ordering or installation. Provide connectors and termination as specified by manufacturer for each application.

1. Provide all cabling with Black jacketing unless otherwise noted.
2. Acceptable manufacturers include Extron, Crestron, Belden, West Penn Wire, Gepco and Liberty. Liberty is specified to establish a cabling baseline. Cross reference equal or greater cabling and connectors when making substitutions with the acceptable manufacturers. Submit substitution requests as described in the submittal requirements section when using a manufacturer not identified as acceptable.

B. Pathway Wire Support

1. Panduit J-Mod Cable Support System
2. Erico Caddy Cat Links J-Hook Series
3. Panduit Plenum Rated Hook & Loop (Black)

C. Fire Stop

1. STI Spec Seal Part Number
2. 3M Products Part Number

D. HD-SDI | Analog Video | Genlock Cabling | CATV(RF):

1. <50’:

    a. Liberty Cable Part# 20-CMP-VID-COAX-BLK.
    b. Terminate with Liberty Part# CM-RG59M-BNC or Liberty Part# 112975 for BNC style Connectors.
    c. Terminate with Liberty Part# CM-RG59M-F for ‘F’ style connectors.

2. 50’-200’:

    a. Liberty Cable Part# 18-CMP-VID-COAX-BLK.
    b. Terminate with Liberty Part# CM-RG6M-BNC for BNC style connectors.
    c. Terminate with Liberty Part# CM-RG6L-F for ‘F’ style connectors.

E. HDBASET Cabling:

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1. Liberty Cable Part# 24-4P-P-L7SH-BLU.
2. Shielded Plenum CAT7 Cable, Blue.
3. Terminate with Liberty Part# 1401405012-I.
4. Use Conductive Copper Foil Tape 3M 3313 series 1-inch to bond the drain connection and the connector. Dress uncovered copper foil tape and cable with heat shrink.
5. Use Igarashi IPS PH-165 or similar type non-marring plastic jaw pliers for connector compression.
6. Space constricted back box or bend radius restricted installations.
7. Terminate with Liberty #A68IPZA-STP keystone insert and install into a keystone plenum rated surface mount box Hubbel #ISB1BKP or similar. Mount in an accessible ceiling space or accessible concealed space and run a plenum rated patch cable from the jack to the device. The plenum rated patch cable is to be same rating/quality or better than the field terminated cabling.

F. Digital Audio Network Cabling:

1. Liberty Cable Part# 24-4P-P-L6ASH-BLK
2. Foil Shielded CAT6a Cable, Black.
3. Terminate with Liberty Part# 1401405012-I.
4. Use Conductive Copper Foil Tape 3M 3313 series 1-inch to bond the drain connection and the connector. Dress uncovered copper foil tape and cable with heat shrink.
5. Use Igarashi IPS PH-165 or similar type non-marring plastic jaw pliers for connector compression.
6. Space constricted back box or bend radius restricted installations.
7. Terminate with Liberty #A68IPZA-STP keystone insert and install into a keystone plenum rated surface mount box Hubbel #ISB1BKP or similar. Mount in an accessible ceiling space or accessible concealed space and run a plenum rated patch cable from the jack to the device. The plenum rated patch cable is to be same rating/quality or better than the field terminated cabling.

G. Network | USB/KVM Extension Cabling

1. Liberty Cable Part# 24-4P-P-L6-EN-BLK.
2. Unshielded CAT6 cable, Black.
3. Terminate with Liberty Part# 11108080034 RJ45 Connector.

H. HDMI | DisplayPort | DVI | USB Passive Cabling

1. HDMI - Liberty Cable Part# HD-600 Series.
2. Provide cable/signal transport of sufficient length to reach from source device to destination device. No digital cable shall exceed a length of 15 feet unless otherwise specified. Provide a high retention cable when available.

I. Serial Control Cabling

1. Single data pair only.
2. Liberty Part# 22-1P-CMP-EZ-BLK.
3. Two data pair RS232(RTS/CTS or RS485).
4. Liberty Part# 24-2P-P485.
5. Terminate all data cabling with a reliable termination system, include hoods and retention mechanisms when available.

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J. Relay | Control Cabling:

1. Liberty 18 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 18-2C-P-BLK.

K. Analog Audio | Microphone | Intercom | IFB Cabling

1. Liberty Part# 22-1P-CMP-EZ-BLK.
2. Terminate cabling with Neutrik XX series for XLR connectors. For ¼" TRS/TS, 1/8" and RCA connectors use Rean manufactured connectors.

L. High Impedance Speaker Level Cabling (25v/70v):

1. < 300':

   a. Liberty 16 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 16-2C-P-BLK.

2. 300' to 500'

   a. Liberty 14 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 14-2C-P
   b. Provide Cable with Black Jacket – Coordinate Cable Color with Architect.

3. > 500': Consult with Manufacturer/Consultant prior to ordering / installation.

   a. Terminate when available with Neutrik "Speakon" type connectors.

M. Low Impedance Speaker Level Cabling:

1. < 50': Liberty 14 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 14-2C-P-BLK.
2. 50' to 100': Liberty 12 Gauge, 2-Conductor Plenum-Rated Cabling – Part Number 12-2C-P-BLK.
3. > 100': Consult with Manufacturer/Consultant prior to ordering / installation.
4. Terminate when available with Neutrik 'Speakon' type connectors.

N. Low Voltage Power Supply Cabling:

1. Provide cabling of sufficient gauge and conductor count as required for power supply in use. Size cabling per manufacturer's device specific minimum required voltage drop.

2.6 ADDITIONAL / UNIT PRICING

A. Provide additional unit pricing if noted on drawings and specifications including additional stock devices or alternates.

B. Provide additional pricing for additional warranty years as required in specifications.

C. Provide additional pricing for warranty for (X) additional years for the entire audiovisual system.

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PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Engineer in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Engineer will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications. In the event of any conflicts between Standards and Codes the more stringent shall take precedence.

B. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), Project State, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Engineer for direction before proceeding with that part of the work.

C. The Contractor shall be responsible for coordination with other trades to ensure any conflicts or potential conflicts are resolved prior to any work beginning on the project.

D. The Contractor shall install the materials in accordance with these specifications and the manufacturer’s installation guidelines.

E. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Engineer. The Contractor shall have written approval from the Architect/Engineer for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Engineer prior to proceeding with the work, the contractor shall not be reimbursed for the work.

F. The Contractor shall obtain written permission from the Architect/Engineer before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

G. Contractor shall notify the Architect/Engineer a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Engineer to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

H. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap cable, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner’s facilities for the disposal of excess or scrap materials.

I. Equipment and materials installed by the Contractor shall be free of defects and damage.

J. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

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K. Contractor shall test all cables prior to installation. By failing to perform this testing operation, the Contractor shall accept the cable as compliant and assume all liability for the replacement of the cable at no cost to the Owner should it be found defective at a later date.

L. Contractor shall maintain a set of working specifications, design drawings, and record drawings to be kept on site at all times and shall update the record drawings with any changes on a weekly basis. Record drawings shall be made available for inspection at the request of the Architect/Engineer.

M. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

N. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

O. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Engineer.

P. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

Q. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

R. Contractor shall be responsible to properly protect information outlets from damage by other trades during construction.

S. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

T. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

U. Contractor shall immediately report to the Engineer any design or installation irregularities, particularly architectural elements that interfere with the intended coverage angles of loudspeakers and projector, so that appropriate action may be taken.

V. Contractor shall observe all HDBaseT Alliance cable types, lengths, bundling, termination, and patching requirements and limitations when installing audio/video over twisted-pair cabling.

W. Contractor shall observe signal separation and signal separation best practices at all times. Any cabling found to be damaged shall be replaced at no cost.

X. Signals shall be separated and grouped according to type and voltage level.

Y. Contractor shall provide all required conduit and sleeves unless otherwise specified. Contractor shall provide conduit bushings even when it is the responsibility of other trades prior to cable installation.

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Z. Contractor shall provide and utilize rear rack rails, lacing bars, and any other required cable dressing equipment/supplies to ensure proper industry-standard signal separation is achieved.

3.2 AUDIOVISUAL CONTROL SYSTEMS

A. Contractor shall furnish, install and configure a complete audio/video switching, transport and control system as specified and indicated on the technology drawings.

B. Contractor is responsible for all ancillary AV switching or active components necessary to provide a complete and functional AV system.

C. Contractor is responsible for all AV specific cabling, interconnects, patch cords and other ancillary devices required to provide a complete system.

D. Contractor shall coordinate the programming of the touch panels with the Owner/Design Team. Touch panels shall be branded to reflect the colors and logos of the Owner. This coordination may consist of multiple in-person meetings to ensure that the finished product fully meets the Owner's needs and expectations.

1. Contractor shall fully brief Owner on available configuration settings / options of the program(s).
2. Contractor shall record the Owner's preferences / decisions and build the initial system program(s).
3. Contractor shall deliver a written record including (at minimum):

    a. The Owner's preferences / decisions
    b. Contractor's plan for implementation and its methodology.
    c. The final programming / implementation results.

E. Once the system programming has been completed and implemented, the Contractor shall allow a minimum 2-month evaluation period for the Owner to use the system and provide feedback.

F. After the evaluation period, the Contractor shall coordinate with the Owner to gain feedback on the system operation. The Contractor shall record the Owner's feedback and provide programming adjustments to resolve any items as directed by the Owner.

G. Contractor shall install the entire control system as specified in accordance with manufactures guidelines and industry best practices.

H. Control processor(s) shall be connected to an un-switched power outlet. Control processor(s) shall be connected to UPS outlet(s) if available.

I. Control system shall be programmed in a manner consistent with current industry best practices.

1. Control functions shall include (but are not limited to) the following:
2. System/Device Power On/Off.
3. Display Source and Sink Switching.
4. Program Volume Adjustment.
5. Audio DSP Control.

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J. All network-enabled control systems shall be provided with virtual 'soft' control panel client(s)

K. All control system programming shall be delivered to the Owner. The Programmer shall transfer all source code/files related to the system. All programming shall be delivered in both compiled and non-compiled form. Upon system acceptance, ownership of the control programming shall be transferred to the Owner for their future use or modification. No claim shall be made by the programmer for continued licensing or other ongoing fees for continued usage of the control system program.

3.3 CABLE INSTALLATION

A. All cables shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc.

B. When cables leave the main pathway systems, they shall be installed and supported in Contractor furnished and installed j-hooks or saddle straps.

C. No cable pathway shall exceed NEC limited low voltage fill ratios.

D. The contractor shall furnish a separate j-hook or saddle strap pathway for each cable type (data, voice, video and security).

1. J-hooks and saddle straps shall be installed no more than five-feet (5') apart on center, using only manufacturer-approved installation methods and hardware.
2. J-hooks shall be furnished with closure clips.
3. Maximum sag between supports shall not exceed twelve-inches (12").
4. Contractor shall establish j-hook and saddle strap pathways and shall coordinate pathways with all other disciplines. Under no-circumstances shall these pathways be used to support other low-voltage applications not included in this specification.
5. The Contractor shall install no more than (1) hook & loop strap between each j-hook or saddle strap or at service loop locations.

E. No nylon cable ties shall be used at any time during the installation of the cable.

F. Signal separation guidelines and best practices shall be observed for the complete length of all cable runs.

G. Above Ceiling-Contractor shall furnish and install plenum-rated hook & loop straps in plenum-rated airspaces.

H. Equipment Rooms / Telecommunications Rooms- The Contractor shall bundle all visible cables with Contractor furnished and installed hook & loop straps.

I. Hook & loop straps shall be installed twenty-four (24) inches apart on center.

J. Plywood-The Contractor shall furnish and install 8' H x 4' W x ¾" D sheets of BC grade fire-rated plywood as when in the technology drawings.

K. The Contractor shall mount all plywood vertically starting at 24" AFF.

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L. The Contractor shall cover the plywood with two (2) coats of Contractor furnished white fire retardant paint leaving exposed (1) fire rating stamp per sheet

3.4 DEVICE IDENTIFICATION

A. Contractor will permanently affix labels to each cable. Labels will be affixed at a distance of 3” from the end of each cable end. If label cannot be easily viewed from this placement, cable may be placed 1” from the cable end. Cable label shall include unique cable number, source system name, source termination point, and destination system name and destination termination point. Cable labels will be identical on each cable end. Contractor to contact Consultant for additional information, if necessary.

B. Contractor will provide equipment labeling for each device front and back according to the system name used in the shop drawings. Contractor may use laminated labels (white print on black labels in front, black print on yellow in back) or equivalent.

C. Contractor will provide engraved plastic laminate labels for all racks. Rack labels to be 1” x 2” with white lettering (Arial font) on black matte finish, plastic.

D. Contractor will provide all Input/Output (I/O) panels. I/O panels will be produced from black anodized aluminum and engraved with white lettering.

3.5 ACCEPTANCE REQUIREMENTS

A. Audiovisual System Testing and Configuration shall be completed by the AV integrator for substantial completion schedule. Integrator shall provide written documentation that room has been completed and ready for commissioning and testing with owner and or consultant.

B. Integrator shall schedule commissioning and testing session with owner as part of final substantial completion of system. Provide written documentation of completion and acceptance date by owner.

C. Audiovisual System Testing and Configuration

D. Contractor shall un-pack and pre-test equipment prior to installation into the production environment. All configurations shall be re-verified prior to the units being placed into service.

E. Contractor shall test and commission each component per the specifications and manufacture’s installation instructions.

F. Contractor shall test and verify for full operational and network support control functionalities and connections per the specifications and manufacturer’s installation instructions.

G. All network devices shall be verified for link and auto negotiation to the highest connection rate.

H. Audio conferencing systems shall be configured to provide excellent audio performance. Verify POTS or VoIP phone system with Owner/Owner/Consultant prior to ordering and installation. Contractor shall place test calls utilizing the audio conferencing system to the system manufacturer for system calibration and testing.

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I. Video conferencing systems shall be configured to provide excellent audio performance. Contractor shall place test calls utilizing the video conferencing system to the system manufacturer for system calibration and testing.

J. Contractor shall test and verify all functionalities as installed per the specifications and manufacturer's installation instructions.

K. All Crestron Digitalmedia demonstration and acceptance tests shall be performed by a Crestron Digitalmedia Certified Engineer (DMC-E).

L. Projector(s) shall be installed square in relation to the screen, and shall be adjusted to fit and fill the screen fully. Projector(s) shall be overscanned slightly into the screen border (if applicable). Projected image shall be square and level. Projector(s) shall be installed so that digital keystone correction is not utilized.

M. In situations where keystone correction may be required, notify Owner/Consultant and coordinate solution prior to installation.

N. Projector(s) shall be installed in such a way that the axis of the lens is perpendicular to the plane of the projection surface.

O. In case of mismatch between projector aspect ratio and screen aspect ratio, projector shall be configured to output at screen aspect ratio.

P. In case of mismatch between display device and signal aspect ratio, system shall be configured such that the source image best fits and fills the display device.

Q. Unless noted otherwise, all projection screens shall be mounted with the lower edge of the viewable image area at 48" A.F.F.

R. Provide additional black drop as required.

S. Video display system(s) minimum test protocols:

1. Test each video display system with test signal generating equipment capable of outputting the following resolutions. (Ultra HD and 4K resolutions required only when testing 4K systems)
2. 4:3 - 640x480, 800x600, 1024x768
3. 16:9 - 1280x720 (720p), 1366x768, 1600x900, 1920x1080 (1080p), 3840x2160 (Ultra HD), 4096x2160 (DCI 4K).
4. 16:10 - 1280x800, 1440x900, 1680x1050, 1920x1200
5. Test signal generator must be capable of outputting the correct signal protocol using the applicable connectivity (RCA/BNC, S-Video, VGA, DVI, HDMI, Displayport, Etc.).
6. The test signal generator must be capable of outputting a standard set of color bars, grid pattern, grayscale, checkerboard and multi-burst.

3.6 TRAINING

A. Contractor shall provide a proposed training schedule to the Owner/Consultant prior to substantial completion.

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B. Contractor shall provide a proposed training syllabus for both administrative users and end-users prior to substantial completion.

C. Training shall include all aspects of the Audio/Visual System as specified and installed.

D. Contractor shall include provisions within the total cost proposal for a minimum of two (2) System Administrator training sessions. It is anticipated these trainings will cover advanced functions of the system, trouble-shooting techniques and other subject matter pertinent to the on-going support of the video conference system at the installed facility. System administration training sessions should be planned for approximately 5 persons. Each training session shall be planned for at least 3 hours per session.

E. Contractor shall include provisions within the total cost proposal for a minimum of three (3) End-User training sessions. It is anticipated this training will cover basic function and operation of the system by faculty. This would include event display management, source control and general systems operation for all installed system. User training sessions should be planned for approximately 10 persons each session. Each training session shall be planned for at least 3 hours per session.

3.7 CLOSE OUT DOCUMENTATION

1. Contractor shall provide full close out documentation for project including floor plan drawings, product data, signal flow diagrams, point-to-point wiring diagrams, programming documents and files, testing documents, training documents, and all relevant documentation to the project.
2. All revisions from initial bid documents shall be included in the documents including ASI, PR, RFI, and Field condition revisions.
3. Close Out documentation shall be delivered to consultant, owner, and architect no later than (30) days after substantial completion.

END OF SECTION 274116

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SECTION 27 5100
DISTRIBUTED COMMUNICATION

PART 1 - GENERAL

1.01 This section identifies the requirements, technical design, and specifications for the distributed communication systems (public address / intercom) for the Willis ISD Turner Elementary School renovation. The distributed communication systems (pa) as specified are industry-standard and include paging/public address systems.

1.02 The contractor shall provide a manufacturer's performance certification for the installed pa systems.

1.03 Contractor shall include materials, equipment, and labor necessary to provide a complete and functional pa system regardless of any items not listed or described in this specification or associated drawings.

1.04 In case of discrepancy between or within these specifications and the associated drawings, the contractor will be assumed to have provided the greater quantity, higher quality, and/or more difficult and therefore higher cost option. Contractor is responsible to submit any questions that may arise in writing. Contractor is not to proceed with work in question without formal written approval from the design team**.**

1.05 REQUIREMENTS

1. Contractor Experience Requirements
2. Submittal Requirements
3. Acceptable Manufacturers
4. Codes, Standards and Regulations
5. General Requirements
6. System Requirements
7. Testing Requirements
8. Project Closeout Documentation
9. Attachments

1.06 DESCRIPTION OF WORK

1. The Owner will provide a new CareHawk head-end system for the PA system expansion. The head-end equipment is Owner-furnished and Owner-installed.
2. The Contractor shall expand the PA system from the Owner-provided head-end and shall be responsible only for field devices, cabling, raceways, and associated terminations shown on the Drawings and specified herein. The Contractor shall not be responsible for the head-end equipment or its availability at the start of construction.PA Systems:
3. The Public Address (PA) System is comprised of the Carehawk Public Address System, with all speakers, horns, and volume controls unless otherwise noted are tied to this system.
4. The Public Address System shall consist of the Central Control Unit, Administrative Control Console(s), Speakers, Horns, volume controls and all other necessary auxiliary devices to provide a complete and operational communications system.
5. The system shall be capable of multiple open voice intercom paths used for intercom, paging, program distribution, or emergency paging.
6. Paging system contractor to coordinate interconnection with all other relevant systems and to provide interconnect equipment/interfaces/cabling as required to facilitate this interconnection. Systems that the paging contractor may need to interface may include (but not be limited to) systems such as local or large venue A|V system(s), building access control system(s), building fire alarm(s), digital signage systems or other building-wide or district-wide mass notification systems.
7. The public address system shall be compatible with and provide for integration with the school's Cisco Phone system.

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8. Contractor shall coordinate layout and installation of ceiling-mounted speaker and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
9. The intent of this specification is to maximize communications between the classroom and administrative areas while enhancing school safety and reducing maintenance and operational cost.
10. Under this specification, the system shall provide a complete Communication System for the entire school including the outdoor recreational areas.
11. The Communication System shall provide distribution of intercom, overhead paging, class change time tones, and program material.
12. The Contractor shall furnish and install all equipment including, but not limited to, outlet boxes, wiring, speakers, and all other necessary equipment to provide a complete operating system as indicated with the contract documents. Provide all necessary wall plates, specialty boxes, etc., not provided by others.
13. Contractor is responsible to provide shop drawings of the as-installed system.
14. Loudspeakers to be connected in parallel as appropriate. To facilitate future troubleshooting, no parallel speaker chain shall include more than eight (8) loudspeakers. Areas with more than eight (8) loudspeakers shall include home runs of sufficient quantity to ensure that no single run has more than eight loudspeakers.

1.07 RELATED REQUIREMENTS

1. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27, and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents, and shall coordinate them with the work on the project.
2. Contractor Experience Requirements
   a. The Contractor shall possess all relevant Manufacturer Certifications for both the company and individual technicians prior to submitting a bid for the work.
   b. Submitting contractor must be a Carehawk Certified Partner with full warranty privileges prior to submitting a proposal.
   c. The Carehawk Authorized Integrator must have installed a minimum of 3 (three) projects of this size and application or shall arrange for onsite factory assistance during system commissioning.
   d. The Contractor shall have been in business for a minimum of five (5) years.
   e. The contractor shall maintain an adequate parts inventory to perform necessary service and upgrades.
   f. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 300-mile radius of the project site.
   g. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner’s installation, where the systems have been in continuous satisfactory operation for at least one (1) year.
3. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.

1.08 WARRANTY

1. The Contractor shall provide a 1 year (5-days x 8 hours x NBD) parts and services warranty on the audio-visual systems and all installed components.
2. Contractor shall provide separate/broken out pricing for a 2-year support/maintenance/service plan beginning at the end of the standard warranty period. The extended support/maintenance/service plan shall cover all materials, labor, workmanship, and preventative maintenance.

1.09 SUBMITTAL REQUIREMENTS

1. Pre-Installation Submittal

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a. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Design Consultant.
b. Product Data
   1) Manufacturer product data sheets for each proposed system component.
   2) For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted.
   3)
c. Shop drawings of the proposed system installation.
   1) Shop drawings shall be provided clearly depicting any proposed modification to the project drawings. Any modifications shall be highlighted on the shop drawings.
   2) Shop drawings shall be provided indicating proposed mounting arrangements and details of all equipment, including positioning devices, framework supports and interface with adjacent architecture.
   3) Shop drawings shall include equipment locations, equipment mounting method, wall elevations, outlet locations, preliminary cable numbers, proposed cable pathways, system schematics, wiring diagrams, and riser diagrams. Shop drawings shall be submitted on 30” X 42” bond paper.
   4) Shop drawings shall include equipment details. Detail equipment assemblies and indicate dimensions, weights, required clearances, field assembly methods, components, and location of each field connection.
   5) Wiring diagrams at a minimum shall include single-line diagram(s) showing interconnection of components along with cabling diagram(s) showing cable routing.
      a) Speaker circuiting, tap value
      b) Amplifier calculation

b. Contractor shall maintain a set of shop drawings on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Engineer.

d. Itemized list of all equipment, materials and labor required for the installation of the system as specified herein.
c. This list shall be provided in printed and electronic format (Microsoft Excel) and shall contain: Part Number, Description, Unit of Measure, Unit Cost, Quantity, Labor Cost and Extended Cost to provide a complete and functional PA system.

e. Unit pricing for all equipment, materials and labor required for the installation of the systems as specified herein.
d. This list shall be provided in printed and electronic format (Microsoft Excel) and shall contain: Part Number, Description, and Unit Price to Add/Deduct Each Item.

f. Manufacturer Product Certifications for Company.
g. Manufacturer Product Certifications for Installers.
h. Manufacturer Warranty letter.
i. Documentation indicating that Contractor has been in business for (5) years.
j. Address of Contractor’s local office within a 75-mile radius of the project site.
k. Quantity of full time local technicians within a 75-mile radius of the project site.
l. List of five (5) contractor-installed projects of a similar size and scope in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date,

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Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

m. List of completed and ongoing projects with the Owner. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, and Brief Description of Project.

n. System commissioning plan detailing the proposed testing and calibration to verify satisfactory system operation.

2. Post-Installation Submittal

a. The Contractor shall provide three (3) sets of comprehensive drawings accurately depicting the "as-built" condition of the audio-visual systems as it was installed to the Architect/Design Consultant at the time of substantial completion. Final payment will not be made until these as-built documents are received and approved by the Architect/Design Consultant.

e. As-built drawings shall include but not be limited to:

1) Equipment layouts

2) Wall elevations

3) System schematics

4) Wiring diagrams

f. As-Built drawings must be provided in original hardcopy format and on a CD-ROM in AutoCAD rel. 2018 or higher.

g. The Contractor shall provide three (3) sets of as-built documentation for the audio-visual systems to the Architect/Design Consultant at the time of substantial completion. As-Built documentation shall be provided in original hardcopy format and on a CD-ROM.

Documentation shall include but not be limited to:

1) Equipment O & M manuals

2) Installed equipment list (manufacturer model numbers, serial numbers, installed locations, etc.)

3) Configuration information (MAC addresses, IP addresses, etc.)

4) Warranty support information

5) Documentation shall be bound, sectioned and tabbed in the following order (when applicable):

6) Equipment O&M Manuals

7) Installed Equipment List

8) Configuration Information

9) Warranty Support Information

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a) The Contractor shall furnish the original Letter of Warranty to include the name, address and phone number contacts for warranty call outs to the Architect/Design Consultant at the time of substantial completion.

b) Contractor shall provide a “By Name” point of contact for contingencies during the one year warranty period.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

1. The following sections specifically list the acceptable equipment types and items for this project.
2. Architect/Design Consultant will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.
3. Proposed equivalent items must be approved in writing by the Architect/Design Consultant prior to submitting a bid. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.
4. In the event a manufacturer’s specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer’s part number.
5. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.
6. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.
7. All wiring, equipment, and installation materials shall be new and of the highest quality.
8. Labels on all wiring, materials, and equipment must indicate a nationally recognized testing laboratory.
9. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Engineer which certifies performance characteristics and compliance with industry standards.

2.02 ACCEPTABLE MANUFACTURERS

1. Public Address System
   a. Care Hawk Call Button – Part number CS25
   b. Care Hawk Switching Security Card 16 Port – Part number SS16
   c. Care Hawk Switching Security Card 32 Port – Part number SS32
   d. Care Hawk Phone Device – AP1-B
   e. Lowell Volume Control – Part number – 10VLC
   f. Atlas Sound APF series square surface enclosure 6” deep for surface and outside locations – Part number l20-213
   g. Atlas Sound Vandal proof baffle for AFP loud speaker – Part number VP161A-APF.
   h. Atlas horn speaker for outside locations – Part number APF-15T.
   i. Quam 8” speaker, 5 ounce magnet, 5w-25/70v transformer for surface locations – Part number 8C5PAX/TBLUB
   j. Quam 1’ x 2’ tile replacement loudspeaker for lay in ceiling locations – Part number System 5.
   k. Garvin ¾” beam clamp – Part Number BC1-Clamp
   l. Caddy Bridal Ring – Part number 2BRT12
   m. Caddy J-hook – Part number CAT-12
   n. West Penn Cat5e 24/4pr plenum (grey) – home run cable – Part number TBD
   o. West Penn 22/2 STR OAS CMP (Grey) speaker cable – Part number 25291-GREY.
   p. West Penn 22/1 PR STR SHLD-22/1PR/STR/NS/CMP (Grey) – Microphone Cable – Par number 25357-GREY

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q. West Penn 22/1PR/STR/SHLD-22/1PR/STR/NS/WET AREA – Audio/Contact Closure Between Buildings – Part number AQC357.
r. Care Hawk Wall Mounted Clock – Part Number 24ZB40
s. Care Hawk Double Sided Clock Housing – Part Number 110-3902
a. Contractor shall provide and install all required parts and pieces to support a complete Turnkey PA and Clock System to include parts and pieces not listed in this specification.

PART 3 - EXECUTION

3.01 CODES, STANDARDS, REGULATIONS

1. TIA-526-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7
2. TIA-526-14-A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – OFSTP-14
3. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements
4. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements - Addendum 1 – Minimum 4-Pair UTP and ScTP Patch Cable Bend Radius
5. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 2 – Grounding and Bonding Requirements for Screened Balanced Twisted-Pair Horizontal Cabling
6. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 3 – Supportable Distances and Channel Attenuation for Optical Fiber Applications by Fiber Type
7. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements > Addendum 4 – Recognition of Category 6 and 850 nm Laser Optimized 50/125 µm Multimode Optical Fiber Cabling -
8. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 5 – Telecommunications Cabling for Telecommunications Enclosures
9. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements Addendum 7 - Guidelines for Maintaining Polarity Using Array Connectors
10. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components
11. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 1 – Transmission Performance Specifications for 4-Pair 100 ohm Category 6 Cabling
12. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 2 – Revision of Sub-clauses
13. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 3 – Additional Considerations for Insertion Loss & Return Loss Pass/Fail Determination
14. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 4 – Solderless Connection Reliability Requirements for Copper Connecting Hardware
15. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components
16. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 6 – Category 6 Related Component Test Procedures
17. TIA-568-D, Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components – Addendum 11 - Specification of 4-Pair UTP and SCTP Cabling

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18. TIA-568-D, Optical Fiber Cabling Components Standard
19. TIA-569-E Commercial Building Standard for Telecommunications Pathways and Spaces -
20. TIA-606-D, Administration Standard for Commercial Telecommunications Infrastructure
21. ANSI J-STD-607-D Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
22. TIA-758-E Customer-owned Outside Plant Telecommunications Infrastructure Standard
23. AIA
24. Local
25. NEC
26. ISO
27. FCC
28. UL
29. OSHA
30. NFPA
31. NEMA
32. Plenum Applications
33. Applicable Flame Test: UL 910 (NFPA 262).

3.02 CONTRACT DOCUMENTS ARE DETAILED ONLY TO THE EXTENT REQUIRED TO SHOW DESIGN INTENT. IT SHALL BE UNDERSTOOD AND AGREED UPON BY THE CONTRACTOR THAT ALL WORK DESCRIBED HEREIN SHALL BE COMPLETE IN EVERY DETAIL. CONTRACTOR SHALL:

1. Furnish additional items not mentioned herein to meet requirements as specified without claim for additional payments. Items, may include hardware, rack panels, 66 Blocks etc., and other devices that are required for installation.
2. Ensure that all labor furnished be manufacture trained and experienced in telecommunication and networked systems.
3. Ensure that all equipment unless otherwise specified, shall be new, free from defects, and of the best craftsmanship in its class.
4. Perform initial programming of system and audio level adjustments.
5. Perform final programming of system and audio level adjustments.
6. Provide system documentation including equipment manuals and drawings.
7. Guarantee all equipment and components for their specified period from date of acceptance.
8. Provide information on system requirements to any Contractor responsible for supplying related materials for this system.
9. The Contractor shall verify all ceilings with specified speaker types prior to installation. Contractor is responsible to provide speaker types as required to mount in the specified locations. If the speaker types are found to be incompatible with the ceiling types, the contractor shall notify the Architect / Design Consultant. If the contractor does not notify the Architect / Design Consult of any discrepancies, the installation will be assumed to be accounted for in the highest quality and most costly and/or difficult manner.
10. The Contractor shall be responsible for, and repair all damage to buildings due to carelessness of workmen, including ceiling tiles, and exercise all reasonable care to avoid any damage to the Owner's property. The Contractor shall make note of all existing damage, and provide photographs of the damage, prior to beginning any work.

3.03 IN THE EVENT OF ANY CONFLICTS BETWEEN DOCUMENTS REFERENCED HEREIN AND THE CONTENTS OF THIS SPECIFICATION, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER IN WRITING OF ANY SUCH OCCURRENCES BEFORE PURCHASING OR INSTALLING ANY EQUIPMENT OR MATERIALS. THE ARCHITECT/DESIGN CONSULTANT WILL NOTIFY THE CONTRACTOR OF ANY ACTIONS REQUIRED TO RESOLVE THESE CONFLICTS. SUCH ACTIONS MAY INCLUDE BUT ARE NOT LIMITED TO: DESIGN CHANGES, EQUIPMENT, MATERIALS AND/OR INSTALLATION CHANGES. IN ANY

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EVENT CONTRACTOR SHALL NOT SUPERSEDE SPECIFICATIONS AND STANDARDS FROM THE LATEST NFPA AND NEC PUBLICATIONS.

3.04 GENERAL REQUIREMENTS

1. Contractor shall comply with the requirements of local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Design Consultant for direction before proceeding with that part of the work.
2. The Contractor shall install the materials in accordance with these specification and the manufacturer's installation guidelines.
3. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Engineer. The Contractor shall have written approval from the Architect/Design Consultant for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Design Consultant prior to proceeding with the work, the contractor shall not be reimbursed for the work.
4. The Contractor shall obtain written permission from the Architect/Design Consultant before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.
5. Contractor shall notify the Architect/Design Consultant a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Design Consultant to perform a walkthrough, review the scope of work, schedule, and escalation procedures.
6. The Contractor shall maintain a work area free of debris, trash, empty cable reels, scrap wire, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.
7. Equipment and materials installed by the Contractor shall be free of defects and damage.
8. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.
9. Contractor shall test all equipment prior to installation. By failing to perform this testing operation, the Contractor shall accept the equipment as compliant and assume all liability for the replacement of equipment at no cost to the Owner should it be found defective at a later date.
10. Contractor shall maintain a set of working specifications, design drawings, and shop drawings to be kept on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Engineer.
11. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.
12. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.
13. Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Engineer.
14. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.
15. Cables shall be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.
16. Contractor shall be responsible to properly protect equipment from damage by other trades during construction.

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17. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.
18. Any cabling installed in or passing through a ceiling space must be plenum rated.
19. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess. Use lacing bars in cabinets.
20. Control-Circuit Wiring: Install number and size of conductors as recommended by system manufacturer for control functions indicated.
21. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs as specified by BICSI TDMM 13 Edition.
22. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
23. Weatherproof Equipment: For units that are mounted outdoors, in damp locations, or where exposed to weather, install consistent with requirements of weatherproof rating.
24. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.
25. The Communication System shall provide at least the following functions and features:
    a. The central control unit shall have the capacity for expanding the system to 300 stations, 125 staff phones, and 4 Administrative Consoles with the addition of plug in modules, as required.
    b. It shall be complete with circuitry for accomplishing all functions for signaling and communications to all stations, page zones, and administrative control consoles. The unit shall contain all required electronics on modular, plug-in type boards for ease of service and future expansion.
    c. All programmable functions shall be stored in a non-volatile EEPROM memory and shall not be lost in event of a power failure.
    d. Programming functions shall be accomplished through the use of a standard Windows Internet browser. Any PC connected to the school network and provided with the proper authorization shall have multi-level access to the system for programming. Any off-site PC shall have multi-level access to the system through the use of the public Internet, provided they have been granted proper authorization by the school.
    e. Diagnostic functions shall be accomplished through any PC connected to the school network and provided with the proper authorization and diagnostic software. Any off-site PC shall have access to the system for diagnostics through the use of the public Internet, provided that they have been granted proper authorization and have been provided diagnostic software.
    f. The audio channel(s) shall be priority driven allowing for the highest priority signal type access to a voice channel. The system shall be user programmable to allocate, upon demand, either of the channel(s) to facilitate simultaneous intercom conversations, pages, program distributions, or combination thereof.
    g. The Central Control Unit shall provide a 0 dB signal for connections to an external amplifier for distribution of program audio, time signals and paging announcements.
    h. The system shall be capable of multiple open voice intercom paths used for intercom, paging, program distribution, or emergency paging.
    i. The system shall support direct-dialing, two-way communications between all locations equipped with Administrative Control Consoles or telephones to any location equipped with a speaker.
    j. The system shall provide communications between telephone and public address/ intercom system. Systems providing broadcast only and are not capable of listening to rooms are not acceptable.
    k. Pre-announce tones shall alert the classroom of incoming calls with distinct tones for each priority level.

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l. The system shall be integrated with customer phone system allowing the capability to page and conduct voice intercom with any speaker in the system.
m. Provide emergency and All Call paging through All Call and a minimum of 24 zones of group paging. The paging zones shall be independent of the time tone and audio program distribution zones. Systems sharing zones for both paging and time tone shall not be acceptable.
n. The system must have the capability of distributing audio program sources from any administrative control console, telephone system phone or intercom system DTMF phone. Program distribution shall be accomplished on an all rooms basis, selected rooms basis or an individual room.
o. The paging system and the phone system must be integrated together to allow the phone system to call over the paging system.
p. The system shall support the automatic distribution of user programmable, class change time signals (Bell Schedule) to all selected areas.
q. Furnish and install a complete new Time Synchronization System using Carehawk Time Synchronization Systems.
r. Furnish and install all system equipment, devices, accessories, and material in accordance with these specifications and drawing to provide a complete and operating system.
s. All bids shall be based on the equipment as specified herein. The model designations are that of Carehawk. The specifying authority must approve any alternate system.
t. System shall continually synchronize clocks and/or timers, and shall be capable of clock readouts in multiple time zones where desired.
u. The Master Time Source shall be NTP. Coordinate NTP server selection and configuration with PA system and District IT representative(s).
v. Clocks shall automatically adjust for Daylight Saving Time in locations where DST is observed.
w. Each clock and/or timer and every other component in the system shall use both precise time and synchronized time.
x. The system shall include an internal clock reference so that failure to detect the master time source shall not result in the clocks failing to indicate time.
y. System shall incorporate a “fail-safe” design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.
z. Clock locations shall be as indicated in the technology drawings.
aa. Contractor shall coordinate with the owner the clock locations, sizes, clock mounting (single sided, double sided) requirements prior to purchase.
bb. Contractor shall provide coordination and support to the owner, clock system connectivity with the owner provided / owner installed server system to ensure clock synchronization and bell scheduling is correct.
cc. Operational Test: Test originating station-to-station, all-call, and page messages at each intercom station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on the system.
dd. The Contractor shall coordinate the commissioning of the paging system in conjunction with the fire alarm system and with the fire alarm installer since the two systems are integrated.
ee. Contractor shall test all equipment prior to installation. By failing to perform this testing operation, the Contractor shall accept the equipment as compliant and assume all liability for the replacement of equipment at no cost to the Owner should it be found defective at a later date.
ff.

26. Cabling and Pathways

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a. The Intercom contractor shall provide cabling and the means to support page ducking (override) in the Gym, Cafeteria, Library, breakout areas and all classrooms. If the intercom system is IP based it may mean providing additional IP relay modules.

3.05 SYSTEM REQUIREMENTS

1. Any quantities listed are for reference only. Contractor is responsible for furnishing materials as required to provide a complete and functioning system. 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/quality shall be furnished.
   a. Contractor shall provide installation in accordance with Manufacturer's installation instructions.
   b. Contractor shall load the latest firmware updates on all equipment and components.
   c. Contractor shall energize and commission equipment in accordance with manufacturer's instructions and guidelines.
   d. Contractor shall provide final adjustments. Upon completion, the equipment shall be clean, adjusted and left in perfect operating condition.
   e. Equipment shall be clean, adjusted and left in perfect operating condition.
2. Public Address System:
   a. Contractor shall furnish and install the following as indicated on the technology drawings and associated equipment schedules and diagrams.
   b. Contractor shall provide installation in accordance with Manufacturer's installation instructions.
   c. Contractor shall load the latest firmware updates on all equipment and components.
   d. Contractor shall energize and commission equipment in accordance with manufacturer's instructions and guidelines.
   e. Contractor shall provide final adjustments. Upon completion, the equipment shall be clean, adjusted and left in perfect operating condition.
3. Attenuators (Volume Controls)
   a. Contractor shall furnish and install the following as indicated on the technology drawings and associated equipment schedules and diagrams.
      a. Type 1:

         1) Single Gang Attenuator

   b. Contractor shall provide installation in accordance with Manufacturer's installation instructions.
   c. Contractor shall energize and commission equipment in accordance with manufacturer's instructions and guidelines.
   d. Contractor shall provide final adjustments. Upon completion, the equipment shall be clean, adjusted and left in perfect operating condition.
4. Loudspeaker(s)
   a. Contractor shall furnish and install the following as indicated on the technology drawings and associated equipment schedules and diagrams.
      b. Type 1:

         1) Ceiling Mounted Loudspeaker

            a) Provide T-Bar as Required

            b) Coordinate Finish with Architect.

            c) Tie off to ceiling grid and building structure as required by site conditions and building codes.

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c. Type 2:

1) Exterior Horn Speaker

a) Coordinate Finish with Architect

b) Coordinate Finish with Architect.

c) Contractor shall provide a Horn Type loud speaker with protective cage for inside the Gym as well.

b. Contractor shall provide installation in accordance with Manufacturer's installation instructions.
c. Contractor shall energize and commission equipment in accordance with manufacturer's instructions and guidelines.
d. Contractor shall provide final adjustments. Upon completion, the equipment shall be clean, adjusted and left in perfect operating condition.

5. Paging System Cabling:
a. All indoor cabling shall be plenum rated. All outdoor cabling shall be outdoor rated and direct-burial rated when in contact with grade or within conduit in contact with grade. Coordinate all cable colors with Owner/Consultant prior to ordering or installation. Provide connectors and termination as specified by manufacturer for each application.
b. The PA system shall be designed so the speakers in each applicable MDF and/or IDF wiring boundary are cabled from the applicable MDF and/or IDF.
c. The speaker cables shall maintain separation from all other cables (data, voice, video, clock, intrusion detection, Access Control/Data Gathering Panel, CCTV, etc.) and shall not share the same J-hook pathway or conduit.
d. Each PA system cable shall be provided with 10 foot service loop at each end and at each speaker where daisy-chained.
d. Speakers in large areas such as gymnasiums, cafeterias, hallways, courtyard, or the exterior may be daisy-chained with the specific area. This cable shall be installed and terminated by the cable contractor in the MDF and/or IDF room.

e. Paging system and Infrastructure installation:

f. Paging system and Infrastructure: Provide and install Carehawk Page Control Unit in the MDF room. Provide and installation will include new power supply and will be cross-connected to Cisco IP phone system.

g. **Classroom, Hallway and Restroom:**

h. Provide and install required Carehawk Self-amplified ceiling speakers throughout the classrooms, hallways and restrooms 1st floor and other floors as shown on the drawings .

i. speakers at the hallways, 1 speaker at each classroom, 1 speaker at each restroom)

j. **Gym:**

k. Provide and install required horns in the GYM as shown on drawings.

l. **Outdoor:**

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m. Provide and install as necessary Carehawk horns on the exterior of the school. All horns will be connected directly to the new Carehawk Volume Control in the Front office.

n. **Other:**

o. Speakers must be connected, working and tested with controller system. Paging cable must be grey color. UTP Cat6 plenum class. J-Hook with Batwing necessary.

p. The owner needs paging programming for zones with Cisco phone system. Paging system must be programed, configured paged by Cisco IP phone system. Certification and testing is necessary.

q. Refer to technology drawings for zoning requirements.

6. Cable Support:
   a. All cables shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc. as indicated in the technology drawings.
   b. When cables leave the main pathway systems as indicated on the technology drawings, they shall be installed and supported in Contractor furnished and installed j-hooks or saddle straps.
   c. No cable pathway shall exceed 40% fill ratio.
   d. The contractor shall furnish a separate j-hook or saddle strap pathway for each cable type (data, voice, video and security).
   e. J-hooks and saddle straps shall be installed no more than five-feet (5') apart on center, using only manufacturer-approved installation methods and hardware.
   f. J-hooks shall be furnished with closure clips.
   g. Maximum sag between supports shall not exceed twelve-inches (12").
   h. Contractor shall establish j-hook and saddle strap pathways and shall coordinate pathways with all other disciplines. Under no-circumstances shall these pathways be used to support other low-voltage applications not included in this specification.
   i. Cable Dressing
   r. No nylon cable ties shall be used at any time during the installation of the cable.

   s. Above Ceiling

      1) Contractor shall furnish and install plenum-rated hook & loop straps in plenum-rated airspaces.

         a) The Contractor shall install no more than (1) hook & loop strap between each j-hook or saddle strap or at service loop locations.

   t. Equipment Rooms / Telecommunications Rooms

      1) The Contractor shall bundle all visible cables with Contractor furnished and installed hook & loop straps.

         a) Hook & loop straps shall be installed twenty-four (24) inches apart on center.

3.06 FIELD QUALITY CONTROL

1. Manufacturer's Field Service: A factory representative shall be onsite to assist in system programming and commissioning.

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a. Perform the following field tests and inspections:
b. Schedule tests with at least seven days' advance notice of test performance.
c. After installing school intercom and program equipment and after electrical circuitry has been energized, test for compliance with requirements.
d. Operational Test: Test originating station-to-station, all-call, and page messages at each intercom station. Verify proper routing and volume levels and that system is free of noise and distortion. Test each available message path from each station on system.
e. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
f. Verify the server and devices are running the latest software revisions.

2. Startup Service
   a. Engage a factory-authorized service representative to perform startup service and initial system programming.
   b. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
3. Adjusting
   a. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels and for any initial troubleshooting.
4. Demonstration
   a. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain school intercom and program equipment.

3.07 TRAINING

1. Distributed Communication Systems Training
   a. The contractor shall provide a proposed training schedule to the Architect/Design Consultant prior to substantial completion.
   b. The contractor shall provide a proposed training syllabus for both administrative users and end-users prior to substantial completion.
   c. Training shall include all aspects of the Audio/Visual System as specified and installed. Contractor shall include provisions within the total cost proposal for a minimum of two (2) System Administrator training sessions. Each session shall be planned for a minimum of 4 hours. It is anticipated this training will cover advanced functions of the system, basic trouble-shooting techniques and other subject matter pertinent to the on-going support of the PA Systems at the installed facility.
   d. Contractor shall include provisions with the total cost proposal for a minimum of two (2) End-User training sessions. Each session shall be planned for a minimum of 4 hours. It is anticipated this training will cover basic function and operation of the system by faculty. This would include event display management, source control and general systems operation for all installed systems.
   e. Programming:
      u. Fully brief Owner on available programming options. Record Owner's decisions and set up initial system program. Prepare a written record of decisions, implementation methodology, and final results.

      v. Once initial system programming is implemented, allow owner a 2 month period to utilize system and make comments.

      w. After initial evaluation period coordinate with Owner. Record Owner’s feedback and provide adjustments as requested.

3.08 TESTING REQUIREMENTS

1. Distributed Communication Systems Testing

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a. Contractor shall un-pack and pre-test equipment prior to installation into the production environment. All configurations shall be re-verified prior to the units being placed into service.
b. Contractor shall test and commission each component per the specifications and manufacture's installation instructions.
c. Contractor shall test and verify for full operational and network support control functionalities and connections per the specifications and manufacturer's installation instructions.
d. All PA network devices shall be verified for link and auto negotiation to the highest connection rate.
e. Contractor shall test and verify all Public Address system functionalities as installed per the specifications and manufacturer's installation instructions.
f. Call Back Switches and speakers shall be checked tested by the installing contractor to ensure the system is free of grounds, opens and shorts. The test results shall be provided to the Architect and Owner for review.
g. The contractor shall schedule a mandatory testing and commissioning effort with the owner to confirm the speaker volume in all areas to included but not limited to, admin, common areas, classrooms, gyms, cafeterias, and exterior.
h. The shall coordinate the commissioning of the paging system in conjunction with the fire alarm system and with the fire alarm installer since the two systems are integrated.

3.09 PROJECT CLOSEOUT DOCUMENTATION

1. As-Built Drawings
   a. Drawings shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect/Design Consultant.
   b. Three (3) sets of drawings depicting the condition of the audio visual system as installed.
   c. As-Built drawings shall be produced in AutoCAD 2022 or higher and provided in hardcopy and electronically in .dwg and PDF format.
   d. Hardcopy drawings shall be provided in the original size as issued by the Architect/Design Consultant.
   e. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect/Design Consultant.
   f. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of all projectors, projector mounts, projection screens, wall elevations, cable tray, sleeves, pathways, workstation locations, and labeling scheme.
2. Contactor's Statement of Warranty
   a. Statement of warranty shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Design Consultant.
   b. Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.
   c. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e. Contractor name, Point of Contact, address, phone number and email address) and start and end date for warranty call outs.

END OF SECTION 27 51 00

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SECTION 280513
CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

PART 1 - GENERAL

1.01 SUMMARY

A. This section identifies the requirements, technical design, and specifications for the security system wiring for the Willis ISD Turner Elementary School project, located in Willis, Texas ("Owner"). The specified wiring are Industry-Standard conductors and cables required for a fully functional access control and intrusion detection system.

B. It is the Contractor's responsibility to review this specification and associated project specifications and drawings in their entirety, prior to bidding on the project. By bidding on this project, the contractor acknowledges that they have read and fully understand these specifications, with no exceptions. Contractor shall review the drawings, specifications, and existing conditions prior to bidding on the project. Any discrepancies shall be brought to the attention of the Architect / Design Consultant via request for information (RFI) in writing for evaluation and clarification. If these items are not brought to the attention of the Architect / Design Consultant, the more costly or difficult manner, and the better quality or greater quantity of work shall be provided by the contractor in accordance with the Architect's / Design Consultant's interpretation at no additional cost to the owner.

C. The Contractor shall include materials, equipment, and labor necessary to provide a complete and fully functional security cabling and wiring system regardless of any items not listed or described in this specification or associated drawings.

D. The Drawings, Specifications, General Conditions, Supplementary General Conditions, and other requirements of Division 1 apply to the work specified in Division 27, and shall be complied with in every respect. The Contractor shall examine all of the items which make up the Contract Documents, and shall coordinate them with the work on the project.

1.02 REQUIREMENT SECTIONS TABLE OF CONTENTS

A. Contractor Experience Requirements [Section 1.3]

B. Submittal Requirements [Section 1.4]

C. Acceptable Manufacturers [Section 2.2]

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F. System Requirements [Section 3.3]

G. Testing Requirements [Section 3.4]

H. Project Closeout Documentation [Section 3.5]

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1.03 CONTRACTOR EXPERIENCE REQUIREMENTS

A. The contractor shall possess all relevant cabling manufacturer certifications, state required licensing and permitting required for both the company and individual technicians prior to submitting a bid for the work.

B. The Contractor shall have been in business for a minimum of five (5) years.

C. The Contractor shall have a local office with local technicians and an adequate workforce to complete this project within a 100-mile radius of the project site.

D. The Contractor shall have completed a minimum of five (5) projects similar in size and scope to the Owner's installation, where the systems have been in continuous satisfactory operation for at least one (1) year.

E. Subcontractors shall be identified at the time of bid and comply with the requirements and intentions of these specifications, associated drawings, and related contract documents.

1.04 SUBMITTAL REQUIREMENTS

A. Pre-Installation Submittal

1. Contractor shall not order, purchase, or install any equipment until pre-installation submittals have been accepted in writing by the Architect/Design Consultant.

2. The Contractor shall ensure submittals are submitted in a timely manner to ensure all products can be ordered and received on site in order to not cause any delays. If there are any concerns with any products having long lead times, those products shall be clearly identified in writing so the review and approval can be expedited.

3. All submittals shall be submitted in the same sequence as they are listed in the specifications (i.e. product data in the sequence items are listed in the product data section, manufacturer product certifications for company, manufacturer product certifications for installers, etc.). Submittals not in the proper sequence will not be approved.

4. Contractor shall submit the following for review and approval:

   a. Product data sheets for each proposed system component.

      1) For product data sheets containing more than one (1) part number or product, the Contractor shall clearly identify the specific part number or product being submitted.

   b. Manufacturer Product Certifications for Company.

   c. Manufacturer Product Certifications for Installers.

   d. Manufacturer Warranty letter.

   e. Documentation indicating that the Contractor has been in business for (5) years.

   f. Address of the Contractor's local office within a 100-mile radius of the project site.

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g. Quantity of full-time local technicians within a 100-mile radius of the project site.

h. List of three (3) contractor-installed projects of a similar size and scope that have been in operation for at least (1) year. The Contractor shall provide the following information for each project: Project Name, Project Location, Project Start Date, Project Completion Date, Project Start Cost, Project Completion Cost, Brief Description of Project, Client Point of Contact Name and Phone Number.

i. List of subcontractors performing any work on the project. The list shall clearly identify the subcontractor's legal name and address, the scope of work to be performed by the subcontractors and the overall percentage of the project being provided by the subcontractor. If there are no subcontractors performing any work on the project, submit a statement on company letterhead clearly indicating no subcontractors will be performing any work on this project.

j. The Contractor shall submit a line-by-line specification review acknowledging conformance to the contract documents. If any variances are taken due to a product being discontinued or factory recommended replacement for product reaching end of life the Contractor shall note it on the review as a variance. The specified products will be itemized and listed as an attachment.

B. Shop Drawings

1. The Contractor shall not proceed with any installation until written approval is obtained by the Architect / Design Consultant.

2. Submit a complete set of shop drawings for review and approval to include:

a. Device locations and cable types

b. Wiring regions

c. Home runs to control panels or head-end equipment

d. Cable labeling details

e. Cable schedule or matrix detailing cable type, label, environmental rating, and termination point.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The following sections specifically list the acceptable equipment types and items for this project.

B. Architect/Design Consultant will have final determination of acceptability of all proposed equipment and must approve submitted equipment prior to purchase or installation.

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C. Proposed equivalent items must be approved in writing by the Architect/Design Consultant prior to submitting a bid. Proposed equivalent items must meet or exceed these specifications and the specifications of the specified item.

D. In the event a manufacturer's specified product or part number has changed or is no longer available, Contractor shall substitute the appropriate equivalent manufacturer's part number.

E. In the event of a discrepancy between the specifications and the drawings, the greater quantity and/or better quality will be furnished.

F. For listed products with no part number specified, Contractor shall provide a product that meets the performance requirements of these specifications, industry standard practices, and intended application.

G. All wiring, equipment, and installation materials shall be new and of the highest quality.

H. Labels on all wiring, materials, and equipment must indicate a nationally recognized testing laboratory.

I. Original Equipment Manufacturer (OEM) documentation must be provided to the Architect/Design Consultant which certifies performance characteristics and compliance with industry standards.

J. The Contractor shall review all products specified and required for this project to determine if there are any lead times that may cause a delay with installation and ability to meet schedule. The Contractor shall clearly identify any concerns with lead times in writing to the Architect/Design Consultant prior to submitting a proposal for this work. If the Contractor does not identify any concerns with products having long lead times, it will be understood there are no long lead time issues and the Contractor will have all products on-site when needed to complete the job as required.

K. Ensure all cabling complies with required security system and device communication protocols (e.g., Wiegand, OSDP, RS-485). Non-compliant cabling installed shall be removed and replaced by the Contractor at no additional cost to the Owner.

2.02 ACCEPTABLE MANUFACTURERS

A. Access Control System Cable

1. Indoor

a. RS-485 Communications

1) 24 AWG 1 Pair Shielded Plenum Low-Cap 12.5 pF/ft Yellow Jacket

a) Windy City Wire – Part Number 042004

b. Power Distribution

1) 18 AWG 2 Conductor Non-Shielded Plenum Yellow Jacket

a) Windy City Wire – Part Number 1802PBR-YLW

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c. Access Control Door

1) 4 Element Composite Cable 22-04 UNS + 22-02 UNS + 18-04 UNS + 22-1P OAS LC + 18-02 Plenum Yellow Jacket

a) Windy City Wire – Part Number 4461030-OSDP

B. Intrusion Detection System Cable

1. Indoor

a. Serial Data Bus

1) 18 AWG 4 Conductor Non-Shielded Plenum White Jacket with Yellow Stripe

a) Windy City Wire – Part Number 1804P-WHT-YLW

b. Power Distribution

1) 18 AWG 2 Conductor Non-Shielded Plenum White Jacket with Yellow Stripe

a) Windy City Wire – Part Number 1802P-WHT-YLW

c. Detection Devices (Motions, Glass Breaks, Door Sensors, etc.)

1) 22 AWG 4 Conductor Non-Shielded Plenum White Jacket with Yellow Stripe

a) Windy City Wire – Part Number 2204P-WHT-YLW

C. Video Surveillance / Data Network Cable

1. All data network cabling by Division 27. Reference specifications Section 27 10 00.

D. Pathway Wire Support

1. Panduit J-Mod Cable Support System

2. Erico – CADDY CAT LINKS J-Hook Series

3. Panduit Plenum Rated Hook & Loop (Black)

E. Labeling

1. Indoor

a. Industrial heat-shrink labels sized to fit cable diameter

b. Manufacturer:

1) DYMO Rhino IND Heat Shrink Tube

2) Or equal from Brady

3) Or equal from Hellermann Tyton

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4) Or other approved equivalent

2. Outside Plant

a. All weather permanent adhesive polyester label

b. Manufacturer:

1) DYMO Rhino IND Permanent Polyester

2) Or equal from Brady

3) Or equal from Hellermann Tyton

4) Or other approved equivalent

F. Fire Stop / Fire Stop Sleeves

1. STI Products

2. 3M Products

3. EZ-Path (Sized as Required)

4. Or approved equivalent

PART 3 - EXECUTION

3.01 CODES, STANDARDS, REGULATIONS

A. Local Authority Having Jurisdiction (AHJ)

B. American National Standards Institute (ANSI)

C. Alliance for Telecommunications Industry Solutions (ATIS)

D. Building Industry Consulting Service International (BICSI)

1. Telecommunications Distribution Methods Manual 13th Edition

2. Outside Plant Design Reference Manual 5th Edition

3. ANSI/BICSI 002-2011, Data Center Design and Implementation Best Practices

4. NECA/BICSI 568-2006 – Standard for Installing Commercial Building Telecommunications Cabling

5. NECA/BICSI 607-2011, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

E. Federal Communications Commission (FCC)

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1. FCC Part 15, Radiated Emissions Limits, revised 1998

2. FCC Part 68, Connection of Terminal Equipment to the Telephone Network, revised 1998

F. International Build Code (IBC)

G. International Code Council (ICC)

H. Insulated Cable Design Consultants Association (ICEA)

1. ICEA S-87-640 (2006) Fiber Optic Outside Plant Communications Cable

2. ICEA S-98-688 (2006) Broadband Twisted Pair, Telecommunications Cable Aircore, Polyolefin Insulated Copper Conductors

3. ICEA S-99-689 (2006) Broadband Twisted Pair Telecommunications Cable Filled, Polyolefin Insulated Copper Conductors

I. International Electrotechnical Commission (IEC)

J. Institute of Electrical and Electronics Design Consultants, Inc. (IEEE)

1. IEEE Standard 81-1983, IEEE Guide for Measuring Earth Resistance, Ground Impedance, and Earth Surface Potential of a Ground System

2. IEEE Standard 1100-1999, Recommended for practice for Powering and Grounding Sensitive

3. Electronic Equipment in Industrial and Commercial Power Systems (IEEE Emerald Book)

4. IEEE C2 (2007; Errata 2007; INT 2008) National Electrical Safety Code

5. IEEE Std 100 (2000) The Authoritative Dictionary of IEEE Standards Terms

K. International Organization for Standardization (ISO)

1. International Organization of Standardization/International Electrotechnical Commission (ISO/IEC)

2. ISO/IEC 11801, Information Technology-Generic Cabling for Customer Premises, 1995

3. ISO/IEC 14443-3:2011 – Identification Cards

4. ISO/IEC 14763-1, Information Technology-Implementation and Operation of Customer Premises Cabling-Administration, 1999

L. National Electrical Contractors Association (NECA)

1. NECA 1-2015 Good Workmanship in Electrical Construction

M. National Electrical Manufacturers Association (NEMA)

1. NEMA C62.61 (1993) Gas Tube Surge Arresters on Wire Line Telephone Circuits

N. National Fire Protection Association (NFPA)

1. NFPA-70, National Electrical Code

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2. NFPA-75, Protection of Electronic Computer Data Processing Equipment.

3. NFPA-101, Life Safety Code

4. NFPA-262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

5. NFPA-297, Guide on Principles and Practices for Telecommunications Systems

6. NFPA-780, Standard for the Installation of Lightning Protection Systems.

O. National Institute Standards and Technology (NIST)

P. Occupational Safety and Health Administration (OSHA)

Q. Security Industry Association (SIA)

R. Telecommunications Industry Association (TIA)

1. ANSI/TIA-568.0-D-1, Generic Telecommunications Cabling for Customer Premises.

2. ANSI/TIA-568.1-D, Commercial Building Telecommunications Cabling Standard.

3. ANSI/TIA -568.0-D.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard.

4. ANSI/TIA-568.3-D-1, Optical Fiber Cabling Components Standard.

5. ANSI/TIA–569-E Commercial Building Standard for Telecommunications Pathways and Spaces.

6. ANSI/TIA-606-C, Administration Standard for the Telecommunications Infrastructure.

7. ANSI/TIA-607-D, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises.

8. ANSI/TIA-758-B, Customer-Owned Outside Plant Telecommunications Infrastructure Standard.

9. ANSI/TIA-862-B – Structured Cabling Infrastructure Standard for Intelligent Building Systems

10. ANSI/TIA-1179-A – Healthcare Facility Telecommunications Infrastructure Standard

S. U.S. Department of Agriculture (USDA)

1. RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction

2. RUS Bull 1751F-643 (2002) Underground Plant Design

3. RUS Bull 1751F-815 (1979) Electrical Protection of Outside Plant

4. RUS Bull 1753F-201 (1997) Acceptance Tests of Telecommunications Plant (PC-4)

5. RUS Bull 1753F-401 (1995) Splicing Copper and Fiber Optic Cables (PC-2)

6. RUS Bull 345-65 (1985) Shield Bonding Connectors (PE-65)

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7. RUS Bull 345-72 (1985) Filled Splice Closures (PE-74)

8. RUS Bull 345-83 (1979; Rev Oct 1982) Gas Tube Surge Arrestors (PE-80)

T. Underwriters Laboratories, Inc. (UL)

1. UL 13 Standard for Power-Limited Circuit Cables

2. UL 294 Standard for Video Surveillance System Units

3. UL 294B Standard for Power Over Ethernet (PoE) Power Sources for Video Surveillance Systems and Equipment

4. UL 109 Standard Method for Flame Tests of Flame-Resistant Fabrics and Films

5. UL 1076 Standard for Proprietary Burglar Alarm Units and Systems

6. UL 1581 Reference Standard for Electrical Wires, Cables, and Flexible Cords

7. UL 1666 Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts.

3.02 GENERAL REQUIREMENTS

A. In the event of any conflicts between documents referenced herein and the contents of this specification, the Contractor shall notify the Architect/Design Consultant in writing of any such occurrences before purchasing or installing any equipment or materials. The Architect/Design Consultant will notify the Contractor of any actions required to resolve these conflicts. Such actions may include but are not limited to: design changes, equipment, materials and/or installation changes. In any event the Contractor shall not supersede specifications and standards from the latest NFPA and NEC publications. In the event of any conflict between Standards and Codes the more stringent shall take precedence.

B. The Contractor shall comply with the requirements of the local Authority Having Jurisdiction (AHJ), State of Texas, the National Fire Protection Association (NFPA), and the National Electrical Code (NEC). If the Contractor identifies any item in the plans or specifications that will not strictly comply with the aforementioned laws, ordinances, and rules, the matter shall be referred to the Architect/Design Consultant for direction before proceeding with that part of the work.

C. The Contractor shall be responsible for coordination with other trades to ensure any conflicts or potential conflicts are resolved prior to any work beginning on the project.

D. The Contractor shall install the materials in accordance with these specifications and the manufacturer's installation guidelines.

E. No deviations from the plans or specifications shall be made without full consent in writing of the Architect/Design Consultant. The Contractor shall have written approval from the Architect/Design Consultant for any additional work beyond the Contract Documents prior to beginning such work. If the Contractor does not obtain written approval from the Architect/Design Consultant prior to proceeding with the work, the contractor shall not be reimbursed for the work.

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F. The Contractor shall obtain written permission from the Architect/Design Consultant before proceeding with any work that would necessitate cutting into or through any part of the building structure such as, but not limited to girders, beams, floors, walls, roofs, or ceilings.

G. The Contractor shall perform onsite coordination with the General Contractor, Structural, MEP, and Civil as required to discuss outside plant and inside plant clash detection with other trades.

H. The Contractor shall notify the Architect/Design Consultant a minimum of (2) weeks prior to beginning work and will participate in a pre-construction meeting with the Architect/Design Consultant to perform a walkthrough, review the scope of work, schedule, and escalation procedures.

I. The Contractor shall maintain a work area free of debris, trash, empty wire reels, scrap wire, etc., and dispose of such items on a daily basis and return the site to the original state of cleanliness. The Contractor shall not use Owner's facilities for the disposal of excess or scrap materials.

J. Equipment and materials installed by the Contractor shall be free of defects and damage.

K. Contractor shall be responsible for the repair of any damage caused by the contractor during the installation.

L. The Contractor shall test all wires prior to installation. By failing to perform this testing operation, the Contractor shall accept the wire as compliant and assume all liability for the replacement of the wire at no cost to the Owner should it be found defective at a later date.

M. The Contractor shall maintain a set of working specifications, design drawings, and shop drawings to be kept on site at all times and shall update the shop drawings on a weekly basis. Shop drawings shall be made available for inspection at the request of the Architect/Design Consultant.

N. Equipment and materials shall be consistent throughout the installation. Where multiple units of the same type of equipment and materials are required, these units shall be a standard product with the same manufacturer and model number.

O. Equipment and materials shall be delivered and stored in accordance with the manufacturer's guidelines at the Contractor's expense.

P. The Contractor shall make all stored equipment and materials available for inspection at the request of the Architect/Design Consultant.

Q. All equipment and material used in the installation shall be approved by the manufacturer for the environment in which it is being installed.

R. Cables should be properly supported in accordance with industry standards at all times. Improperly supported cables shall be corrected by the Contractor at no cost to the Owner.

S. The Contractor shall be responsible to properly protect cables from damage by other trades during construction.

T. Cables shall be routed at 90-degree angles to the building structure. At no time shall a diagonal pull be installed.

U. The Contractor shall not install cables in conduits or sleeves without nylon bushings. Cables installed through conduits or sleeves without nylon bushings shall be removed and replaced at no cost to the Owner.

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3.03 SYSTEM REQUIREMENTS

A. The Contractor is responsible for furnishing materials as required to provide a complete and functional system. Quantities are not noted, so the information may be obtained from the security drawings.

B. Access Control System Cable

1. Furnish and install all required cables within each Technology / Security Region from the designated Telecommunications Room (TR) or Equipment Riser (ER) to each device location as indicated in the drawings.

2. All cable types must be UL-listed and rated for the specific environmental condition in which they are installed (e.g., plenum, riser, outdoor, wet location).

3. Ensure the cable gauge is appropriately sized based on the power requirments of each device, and the total cable run distance to ensure proper voltage delivery and signal integrity.

4. Cables shall be routed in dedicated pathways or separated from high-voltage and other non-security cabling by a minimum of 12 inches or per NEC/local code requirements to prevent interference.

5. Where exposed or in unsecured areas, cables shall be installed in metallic conduit or raceway to prevent tampering. EMT or rigid conduit is preferred in high-security zones.

6. Splicing of cables is not permitted unless explicitly approved. All connections shall be continuous from designated TR or ER panel to the device.

7. Furnish and install a 20-foot service loop at the TR or ER, coiled, mounted, and stored above the respective security riser panel or designated termination point.

8. Furnish and install a 10-foot service loop coiled and supported directly above the security device location.

C. Intrusion Detection System Cable

1. Furnish and install all required cables within each Technology / Security Region from the designated Telecommunications Room (TR) or Equipment Room (ER) to each device location as indicated in the drawings.

2. All cable types must be UL-listed and rated for the specific environmental condition in which they are installed (e.g., plenum, riser, outdoor, wet location).

3. Ensure the cable gauge is appropriately sized based on the power requirments of each device, and the total cable run distance to ensure proper voltage delivery and signal integrity.

4. Cables shall be routed in dedicated pathways or separated from high-voltage and other non-security cabling by a minimum of 12 inches or per NEC/local code requirements to prevent interference.

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5. Where exposed or in unsecured areas, cables shall be installed in metallic conduit or raceway to prevent tampering. EMT or rigid conduit is preferred in high-security zones.

6. Splicing of cables is not permitted unless explicitly approved. All connections shall be continuous from designated TR or ER panel to the device.

7. Furnish and install a 20-foot service loop at the TR or ER, coiled, mounted, and stored above the respective security riser panel or designated termination point.

8. Furnish and install a 10-foot service loop coiled and supported directly above the security device location.

D. Cable Support

1. All cables shall be installed and supported in conduit systems, cable trays, cores, sleeves, etc. as indicated in the security drawings.

2. When cables leave the main pathway systems as indicated on the security drawings, they shall be installed and supported in Contractor furnished and installed j-hooks or saddle straps.

3. No wire pathway shall exceed 40% fill ratio.

4. The contractor shall furnish a separate J-hook or saddle strap pathway for each cable type (e.g. data, paging/clock, and security).

5. J-hooks and adjustable cable supports shall be installed no more than five-feet (5') apart on center, using only manufacturer-approved installation methods and hardware.

6. J-hooks and adjustable cable support shall be installed no higher than three-feet (3') above the accessible ceiling to allow for ease of access for future moves, adds and changes

7. Do not utilize ceiling grid support wire; support j-hooks via wall, structure, or threaded rod support to structure.

8. J-hooks shall be furnished with closure clips.

9. Maximum sag between supports shall not exceed twelve (12") inches.

10. Contractor shall establish j-hook and saddle strap pathways and shall coordinate pathways with all other disciplines. Under no circumstances shall these pathways be used to support other low-voltage applications not included in this specification.

11. UNDER NO CIRCUMSTANCES SHALL ZIP TIES BE USED ON ANY CABLING.

12. Cable Dressing

    a. No nylon cable ties shall be used at any time during the installation of the cable.

    b. Above Ceiling

        1) Contractor shall furnish and install plenum-rated hook & loop straps in plenum-rated airspaces.

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a) The Contractor shall install no more than one (1) hook & loop strap between each j-hook or saddle strap or at service loop locations.

c. Equipment Rooms / Telecommunications Rooms

1) The Contractor shall bundle all visible cables with Contractor furnished and installed hook & loop straps.

a) Hook & loop straps shall be installed twenty-four (24) inches apart on center.

E. Equipment Rooms / Telecommunications Room Build-Out

1. Cable Management (Wire Trough)

a. The Contractor shall furnish and install wiring troughs as specified using manufacturer-approved hardware and installation methods per the security drawings.

b. Wire troughs shall be securely fastened to the wall using appropriate anchors or fasteners suitable for the wall material (e.g. concrete, wood, etc.).

c. All wire trough sections shall be supported by cable transitions at room entry/exit points, using vertical and horizontal pathways. Installation shall follow manufacturer guidelines.

d. Provide conduit stub ups with threaded plastic bushings and J-hooks to support cable entering the wiring trough enclosure. Coordinate conduit size and quantity based on total cable counts and cable type.

e. Horizontal wire troughs shall be mounted just above the designated workspace area (e.g. above racks or cabinets), unless otherwise noted on drawings.

f. Vertical wire troughs shall be aligned and centered with horizontal troughs connected via conduit sleeves, unless otherwise noted.

g. Wiring troughs are designated for low voltage cabling only. No 120VAC or non-security related wiring shall route through the trough at any time.

h. Apply labels to cables and troughs as specified to meet Owner labeling requirements. Color-coded adhesive dots may be applied as required to coordinate device rough ins with multiple trades.

i. Ensure wire troughs maintain bend radius requirements for all cable types

j. Provide end caps or covers for open trough ends or knockouts to prevent dust and debris from entering.

k. Include grounding provisions if required by manufacturer or local code.

2. Equipment Panel and Cabinets

a. Coordinate final locations of security equipment panels with other trades prior to installation.

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b. Clearly mark reserved panel dimensions using blue tape or other visible indicators to prevent installation conflicts.

c. Provide service loop of each cable to allow for final terminations.

d. Label each cable per project cable identification standards.

F. Grounding and Bonding

1. All grounding and bonding shall be performed in accordance with Division 26 and Division 27 specifications. Reference those sections for additional requirements related to electrical and telecommunications grounding systems.

2. All exterior and outside plant cabling associated with electronic safety and security systems shall be grounded and bonded in accordance with NEC Article 250 and ANSI/TIA-607-E standards. This includes all metallic cable sheaths, conduits, and support structures.

3. Where outside plant cabling is routed through manholes, handholes, pull boxes, or exterior enclosures, grounding shall be provided at each transition point using ground rods or bonding to existing grounded infrastructure, in accordance with ANSI/TIA-758 and NESC standards.

4. Ensure all equipment racks, cable trays, and metallic enclosures provided as part of the security system installation are bonded to the telecommunications grounding system per ANSI/TIA-607-E and NEC requirements. Bonding conductors should be sized appropriately and installed using UL-listed hardware.

5. Coordinate grounding and bonding of all exterior-mounted security devices (e.g., cameras, access control readers, sensors) with the facility's lightning protection and surge suppression systems. Ensure all devices are bonded to the nearest grounded structure or ground rod, and surge protection is provided on all signal and power lines entering the building.

G. Firestopping

1. Firestopping for Conduits

a. Provide firestopping components as part of a UL System for all conduit penetrations through fire-rated and smoke-rated walls and floors.

b. Coordinate locations and UL System with other trades (Electrical, Telecommunications, Etc.) and indicate locations and UL System number on Pre-Construction Shop Drawings.

c. Affix adhesive wall label immediately adjacent to devices to communicate to future cable technicians, authorities having jurisdiction and others the manufacturer of the device and the corresponding UL System number installed.

2. Firestopping for Backboxes

a. Provide firestopping component(s) as part of a UL tested/approved solution for backboxes located in fire-rated and smoke-rated walls.

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b. Coordinate locations with other trades (Electrical, Telecommunications, Etc.) and indicate locations on Pre-Construction Shop Drawings.

H. System Labeling

1. Contractor shall not apply permanent cable labels until the Owner, Architect or Design Consultant has approved of the proposed labeling scheme. Labels shall align with system programming, as-built documentation, and shop drawings to support a fully coordinated and maintainable installation.

2. The Contractor shall verify room numbers and confirm the final room numbering scheme prior to generating any labels.

3. Cables shall be labeled within twelve (12) inches from the termination point inside the Equipment Room/Telecommunications Rooms.

4. Cables shall be labeled within six (6) inches from the termination point at the device end.

5. Backbone Cables shall be labeled within twelve (12) inches of the visible end of the jacket and at each pull point location. If passing through an IDF it will be labeled when entering and leaving that IDF.

6. Cables shall be labeled identically at both ends.

7. Equipment Racks

   a. Equipment racks in each Equipment/Telecommunication Room shall be labeled in sequential numeric order.

   b. Labels shall be centered on the top front of the equipment rack.

8. Cabinets

   a. Cabinets in each Equipment/Telecommunication Room shall be labeled in sequential numeric order.

   b. Labels shall be centered on the top front of the Cabinet.

9. Security Panel Enclosures

   a. Panels in each closet shall be labeled sequentially starting with the first Panel in the top of the designated wall space (i.e. A, B, C, D, E, etc.).

   b. All panels will indicate the room number along with the panel type. The labels shall be mechanical labels that are neatly printed with uniform font and evenly spaced across the panel. Room numbers will be in sequential order throughout the panels as indicated on the drawings.

10. Backbone Cable

    a. Access Control RS-485

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1) RS-485 backbone cable labels shall contain the cable origin room number, the cable destination room number, termination point, and type (i.e. MDF A111–IDF A211 / LP1502 Port 1 / RS-485 Comm)

b. Intrusion Detection Serial Data Bus

1) Serial Data Bus backbone cable labels shall contain the cable origin room number, the cable destination room number, termination point, and type (i.e. MDF A111 - IDF211 / B9512G SDI2 Bus)

11. Access Control Cables

a. Device cable labels at the device end shall contain the cable origin room number, device label, and device type (i.e. MDF A111 / CR-1-1 / CR)

1) Composite Access Control Cables shall be labelled on the overall jacket before transitioning into individual cables. (i.e. MDF A111 / CR-1-1 / Composite)

b. Device cable labels at the head end shall contain the destination room name with number, device label, and device type (i.e. Lobby A100 / CR-1-1 / CR)

1) Composite Access Control Cables shall be labelled on the overall jacket before transitioning into individual cables. (i.e. Lobby A100 / CR-1-1 / Composite)

12. Intrusion Detection Cables

a. Device cable labels at the device end shall contain the cable origin room number, zone / point label, and device type (i.e. MDF A111 / Point 01 / B9512G)

b. Device cable labels at the head end shall contain the destination room name with number, device label, and device type (i.e. Lobby A100 / Point 01 / MD)

3.04 TESTING REQUIREMENTS

A. Installed cables shall be tested in accordance with industry standards.

B. Only Manufacturer Certified Technicians shall perform testing.

C. The Contractor shall test and certify all cables with approved field tester(s). The Contractor shall be liable for all re-testing required in the event tests are performed with non-approved test equipment or tester(s).

D. The Contractor shall notify the Architect/Design Consultant a minimum of five (5) days in advance to observe wire testing.

E. The Architect/Design Consultant may randomly select 5% of the installed wires for test verification purposes. The Contractor shall re-test these wires in the presence of the Architect/Design Consultant and the results shall be compared to the previously Contractor submitted test results. In the event that any of the verification tests differ in results from the previously submitted test

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results, all testing shall be declared a failure, and the Contractor shall re-test 100% of the installed cables at no cost to the Owner.

F. Cables shall be tested for continuity on all wires to ensure there are no broken conductors, damaged components, ground faults, or excessive resistance.

G. RS-485 cables shall be tested for capacitance and impedance to ensure they are within manufacturer recommended tolerances.

H. Upon completion of testing, the Contractor shall provide a comprehensive test report, certified by a qualified technician, documenting the results for each cable run. The report shall include cable identification, test methods, measured values, and verification that all performance criteria have been met. Submission of the certified test report is a prerequisite to system acceptance.

I. Any deficiencies identified during testing shall be corrected by the Contractor at no additional cost to the Owner.

3.05 PROJECT CLOSEOUT DOCUMENTATION

A. As-Built Drawings

1. Drawings shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until drawings are received and approved by the Architect/Design Consultant.

2. Provide drawings depicting the condition of the security cabling system as installed.

3. As-Built drawings shall be produced in AutoCAD 2018 or higher and provided in hardcopy and electronically in .DWG and PDF format.

4. Drawings shall retain the formatting and title block of the original drawings as issued by the Architect/Design Consultant.

5. Drawings shall be provided utilizing the original scale and shall include the exact dimensions and locations of all associated device locations, backbone connections, telecommunications room boundaries / service zones, sleeves, pathways, enclosures, device locations, and labeling scheme.

6. A laminated copy of the As-Built drawings shall be provided and hung in main security riser panel / telecommunications room. Drawing size will be 30”x42”.

B. Test Documentation

1. Test documentation shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until these test results are received and approved by the Architect/Design Consultant

2. Provide testing documentation for the security cabling system as installed.

3. Test results shall be provided in original electronic format (i.e., manufacturer’s proprietary testing software along with applicable reader software) and PDF electronic format.

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4. Test documentation shall be bound, sectioned, and tabbed in the following sequence as applicable:

    a. Inter-Building Security Backbone Cable

    b. Intra-Building Security Backbone Cable

    c. Access Control System Cable

    d. Intrusion Detection Cable

5. The documentation for each section shall include:

    a. Cable identification and labeling corresponding to drawings and field markings.

    b. Detailed test results for each conductor, including continuity, insulation resistance, polarity, and signal integrity.

    c. Certification of compliance with applicable industry standards, manufacturer specifications, and contract requirements.

    d. Signature and certification of the qualified technician performing the tests.

    e. Date of testing

C. Manufacturer's Product Warranty

1. Certificate of product warranty shall be provided to the Architect/Design Consultant at the time of final system acceptance. Final payment will not be recommended until this certificate of product warranty is received and approved by the Architect/Design Consultant.

2. The manufacturer of the solution shall furnish a product warranty as per the specifications starting at final system acceptance.

3. One original and two copies of the Manufacturer's product warranty shall be provided.

D. Contactor's Statement of Warranty

1. Statement of warranty shall be provided to the Architect/Design Consultant at the time of substantial completion. Final payment will not be recommended until statement of warranty is received and approved by the Architect/Design Consultant.

    a. The Contractor shall furnish a minimum of a one (1) year warranty on all materials, labor and workmanship starting at final system acceptance.

        1) This warranty shall cover repair or replacement of any defective or nonconforming materials, equipment, or workmanship at no cost to the Owner.

        2) The Contractor shall respond to warranty service requests promptly and complete corrective work within a reasonable timeframe not to exceed ten (10) business days unless otherwise agreed in writing.

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3) The warranty shall also include all associated costs, including labor, travel, equipment, and materials, and shall remain valid regardless of subsequent changes in system operation, provided the system has not been misused, modified, or repaired by others.

b. One original and two copies of Contractor's warranty terms and conditions to include contact information (i.e. Contractor name, Point of Contact, address, phone number and email address) and start and end date for warranty period.

c. The Contractor shall be prepared to correct deficiencies found during the 1-year warranty walk through by the Owner.

END OF SECTION 280513

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SECTION 28 4600
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

D. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

A. Section 08 3323 - Overhead Coiling Doors: Coiling fire doors to be released by fire alarm system.

B. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

C. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

D. Section 21 2200 - Clean-Agent Fire-Extinguishing System: Supervisory, alarm, and releasing devices installed in extinguishing system.

E. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 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. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Proposal Documents: Submit the following with cost/time proposal:
   1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
   3. Certification by Contractor that the system design will comply with Contract Documents.
   4. Proposed maintenance contract.

C. Evidence of designer qualifications.

D. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.

3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
4. System zone boundaries and interfaces to fire safety systems.
5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
7. List of all devices on each signaling line circuit, with spare capacity indicated.
8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
10. Detailed drawing of graphic annunciator(s).
11. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
12. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
13. Certification by Contractor that the system design complies with Contract Documents.
14. Do not show existing components to be removed.

E. Evidence of installer qualifications.

F. Evidence of instructor qualifications; training lesson plan outline.

G. Evidence of maintenance contractor qualifications, if different from installer.

H. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

I. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

J. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

K. Closeout Documents:

1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.
4. Maintenance contract.
5. Report on training results.

L. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
4. Certified in the State in which the Project is located as fire alarm installer.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

1.06 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:
1. Honeywell Security & Fire Solutions/Gamewell-FCI; _____: www.gamewell-fci.com/#sle.
2. Other systems approved prior to bidding..
3. Provide control units made by the same manufacturer.

B. Initiating Devices and Notification Appliances:
1. Same manufacturer as control units.
2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. ADA Standards.
   b. The requirements of the State Fire Marshal.
   c. The requirements of the local authority having jurisdiction .
   d. Applicable local codes.
   e. Contract Documents (drawings and specifications).
   f. NFPA 101.
   g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
7. Program notification zones and voice messages as directed by Owner.
8. Fire Alarm Control Unit: New, located at supervising station.
9. Two-Way Telephone: Provide two-way telephone service for the use of the fire service and others; provide jacks and two portable handsets.
10. Combined Systems: Do not combine fire alarm system with other non-fire systems.

B. Supervising Stations and Fire Department Connections:
   1. Public Fire Department Notification: By on-premises supervising station.
   2. On-Premises Supervising Station: New proprietary station operated by Owner, located at _____.
   3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
   4. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

C. Circuits:
   1. Initiating Device Circuits (IDC): Class B, Style A.
   2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
   3. Notification Appliance Circuits (NAC): Class B, Style W.

D. Spare Capacity:
   1. Initiating Device Circuits: Minimum 25 percent spare capacity.
   2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
   3. Speaker Amplifiers: Minimum 25 percent spare capacity.
   4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
   1. Primary: Dedicated branch circuits of the facility power distribution system.
   2. Secondary: Storage batteries.
   3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
   4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing system completely after new system is fully operational and tested.

B. Clearly label components that are "Not In Service."

C. Remove unused existing components and materials from site and dispose of properly.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
   1. Sprinkler water control valves.
   2. Dry-pipe sprinkler system pressure.
   3. Dry-pipe sprinkler valve room low temperature.
   4. Fire pump(s).
   5. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
   1. Sprinkler water flow.
   2. Total flooding suppression system activation.
   3. Kitchen hood suppression activation; also disconnect fuel source from cooking equipment.
   4. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
   5. Duct smoke detectors.

C. Elevators:
   1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
   2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
   3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.

D. HVAC:
   1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

E. Doors:
   1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
   2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.
   3. Overhead Coiling Fire Doors: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 3323.

2.05 COMPONENTS

A. General:
   1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
   2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. In addition to code required components, provide carbon monoxide detectors in all classrooms.

D. Provide wire guards for devices installed in gyms.

E. Master Control Unit: FACP.

F. Remote Annunciators: FAP.

G. Addressable Modules:
1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.
4. Control Modules: Provide as indicated or as required for selective control of notification appliances.
5. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.

H. Initiating Devices:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

I. Notification Appliances:
1. Bells: _____.
a. Provide 1 extra.
2. Speakers: _____.
a. Provide 1 extra.
3. Strobes: _____.
a. Provide 1 extra.

J. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

K. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.

L. Locks and Keys: Deliver keys to Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type

M. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

N. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
1. Padlock eye and hasp for lock furnished by Owner.
2. Locate as directed by Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
   1. All wiring for fire alarm system shall be in conduit. Refer to 26 05 33.13 for conduit applications and 26 05 53 for identification of emergency conduit for electrical systems.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.
   3. Factory Instruction: At control unit manufacturer's training facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

D. Detailed Operation: Two-hour sessions for engineering staff; assume NICET level I qualifications or equivalent; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

E. Maintenance Technicians: Detailed training for electrical technicians, on programming, maintaining, repairing, and modifying; factory training:
   1. Initial Training: One 3-day session, pre-closeout.

F. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

G. Provide means of evaluation of trainees suitable to type of training given; report results to Owner.

3.04 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Specified diagnostic period without malfunction has been completed.
   2. Approved operating and maintenance data has been delivered.
   3. Spare parts, extra materials, and tools have been delivered.
   4. All aspects of operation have been demonstrated to Owner.
   5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   6. Occupancy permit has been granted.
   7. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.05 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and

parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

G. Comply with Owner's requirements for access to facility and security.

END OF SECTION

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SECTION 31 0000
EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Excavating, filling, backfilling, grading, and compacting of earth at the site.
   2. Preparation of building pad to limits shown on plans.
   3. Provide and stockpile topsoil on site.
   4. Dewatering excavations.

B. Related Sections:
   1. Section 01 4516 – Contractor's Quality Control
   2. Section 31 1000 – Site Clearing

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM D 698 Tests Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb. Hammer and 12-in. Drop.
   2. ANSI/ASTM D2922 - Density of Soil in Place by the Nuclear Methods.

1.04 SUBMITTALS

A. Submit in accordance with SECTION 01 3000 – ADMINISTRATIVE REQUIREMENTS.

B. Samples: Submit a one gallon sample and material analysis results of imported topsoil from a testing laboratory indicating compliance with these specifications. Any topsoil delivered to the site which does not comply with the approved sample shall be re-tested at the Contractor's expense and replaced.

C. Test Reports:
   1. Submit copies of test reports in accordance with SECTION 01 4516 – CONTRACTOR'S QUALITY CONTROL.
   2. Compaction Tests: Submit copies of compaction test reports.

1.05 QUALITY ASSURANCE

A. Laboratory Control: On site or Imported topsoil, if required, shall be inspected and tested by an independent testing laboratory.
   1. Testing laboratory shall make tests of the soil from the selected source to determine that it meets the specified requirements for select fill and imported topsoil.

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1.06 PROJECT CONDITIONS

A. Temporary Sheeting: Shore and sheet excavations to protect utilities and to prevent cave-in. Maintain sheeting secure until permanent construction is in place. Remove sheeting as excavations are backfilled.

B. Drainage: Provide for adequate surface drainage during construction to keep the site free of surface water without creating a nuisance in adjacent areas.

C. Pumping: Keep the excavations free of water at all times by pumping or other means. This shall be the responsibility of the Contractor regardless of the cause, source, or nature of the water.

D. Protection:

1. Property: Protect adjoining property, including improvements out-side the limits of the work. Protect walks, curbs, and paving from damage by heavy equipment and trucks.
2. Protect benchmarks.
3. Protect above and below grade utilities which are to remain.
4. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation. Monitor shoring system and surrounding ground surface during construction to detect movement. If movement becomes significant, take contingency steps to brace excavation and adjacent utility lines.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil

1. Strip topsoil from limits of grading areas, clean of grass, roots, rock and debris to a depth of 6”, and stockpile for placement on all landscape and “open space” areas. Contractor shall investigate the site to his satisfaction to determine if suitable material is available on site to meet the specification for topsoil.
2. Refer to landscape architect plans and specifications for additional topsoil requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Establish extent of excavation by area and elevation; designate and identify datum elevation.

B. Set required lines and grades using a licensed surveyor.

C. Maintain benchmarks, monuments and other reference points.

3.02 PREPARATION

A. Before starting excavation, establish location and extent of underground utilities occurring in work area.

B. Notify utility companies sufficiently in advance to remove and relocate lines which are in way of excavation.

C. Maintain, reroute or extend as required, existing utility lines to remain which pass through work area.

D. Protect and support utility services uncovered by excavation.

E. Remove abandoned utility service lines from areas of excavation; cap, plug or seal such lines and identify at grade.

F. Accurately locate and record abandoned and active utility lines rerouted or extended on Project Record Documents.

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G. Upon discovery of unknown utility or concealed condition, discontinue affected work and notify Architect.

H. Remove grass, weeds, roots and other vegetation from areas to be excavated, filled and graded. Fill stump holes and like small excavations with suitable material placed in lifts and thoroughly tamped.

I. Scarify the subgrade soil of pavement areas to a minimum depth of 6 inches and compact to at least 95 percent of Standard Proctor and at a moisture content between optimum and four (4) percent above optimum.

J. Scarify general subgrade soils in place to a minimum depth of 6 inches and compact to at least 95 percent of Standard Proctor and at a moisture content between optimum and four (4) percent above optimum.

3.03 EXCAVATION

A. General: Excavate to the lines, grades and sections shown on the drawings. Allow space for the construction of forms. **All excavation shall be unclassified as required regardless of the condition or type of material encountered, including rock.**

1. Cut areas accurately to the indicated cross-sections and grades. Take care to prevent excavation below the grades indicated. Any bottoms and slopes that are undercut shall be backfilled with earth fill and compacted.
2. Finish the excavating required for graded areas and building pad to a tolerance of one inch above or below the rough grade.
3. Remove underground obstructions except for piping and conduit which shall be handled as specified in SECTION 01 1100 - SUMMARY OF WORK.

B. Over cut planting and lawn areas to allow a layer of topsoil not less than 6" thick.

C. Maintain excavations to drain and be free of excess water. Ponding of water on site will not be permitted.

D. Exercise extreme care in grading around existing trees. Do not disturb existing grades around existing trees except as otherwise noted. When excavation through roots is necessary, and after review by Landscape Architect, perform by hand and cut roots with sharp axe, prune trees to compensate for root loss.

E. Fill over-excavated areas under structure bearing surfaces in accordance with Architect's direction.

F. Do not allow construction equipment to create "pumping" of soils.

G. Stockpile excavated clean fill for reuse where directed. Remove excess or unsuitable excavated fill from site.

H. Over excavate existing soils in saturated conditions. Stockpile wet material. Allow drying out to take place. Mix stockpiled materials with relatively dry onsite material before recompacting.

3.04 WASTING

A. Surplus excavated material not suitable or required for embankment fill and backfill shall be wasted off site.

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3.05 FILL AND BACKFILL

A. Filling: Construct compacted fills to the lines, grades and sections shown on the drawings.

1. Complete stripping and wasting operations in advance of fill construction. Proof roll, compact, and establish moisture content.
2. Deposit and mix fill material in horizontal layers not more than 8" deep, loose measurement. Manipulate each layer until the material is uniformly mixed and pulverized.
3. Fill material shall have moisture content and compaction per Geotechnical Report. If fill is too wet, dry by aeration to achieve desired moisture content. If fill is too dry, add water and mix in by blading and discing to achieve desired moisture content.
4. Exercise care to prevent movement or breakage of walls, trenches, and pipe during filling and compaction. Place fill near such items by means of light equipment and tamp with pneumatic or hand tampers.
5. Proof roll exposed subgrade in building and paving areas with heavily loaded dump truck (25 ton minimum) or similar acceptable construction equipment, to detect unsuitable soil conditions. Commence proof rolling operations after a suitable period of dry weather to avoid degrading acceptable subgrade surfaces. Make four passes over each section with proof rolling equipment, with the last two perpendicular to the first two.
6. Cut out soft areas of subgrade not readily capable of in- situ compaction. Backfill and compact to density equal to requirements for subsequent backfill material.

B. Backfilling: Construct compacted fill against and around concrete beams below finish grade.

1. Verify areas to be backfilled are free of debris, snow, ice or water, and ground surfaces are not frozen.
2. Do not backfill until underground construction has been inspected, tested and approved, forms removed, and the excavations cleaned of trash and debris.
3. Bring backfill to required grades by depositing material in horizontal layers not more than 6" deep, loose measurement.
4. Site backfill systematically, as early as possible, to allow maximum time for natural settlement. Do not backfill over porous, wet or spongy subgrade surfaces.
5. Maintain optimum moisture content of backfill materials to attain required compaction density.
6. Make gradual changes in grade. Blend slopes into level areas.

3.06 COMPACTION

A. Compact each layer of earth fill and backfill to the compaction and density specified.

1. Scarify the subgrade soil of pavement and non-pavement areas to a minimum depth of 6 inches and compact to at least 95 percent of Standard Proctor and at a moisture content between optimum and four (4) percent above optimum.
2. Equipment for compacting shall be sheeps foot and rubber tired rollers or other compactors capable of obtaining the required density. Compact the fill with power tampers and by hand in areas not accessible to rollers.
3. Compact each layer of fill to the density listed below as a function of the location and depth. The required density in each case is indicated as a percentage of the maximum dry unit weight determined using the standard compaction test ASTM D 698.
   a. Material under paving ---------- 95%
   b. Material under lawn areas ---------- 95%.
   c. Material under building----------Per Geotechnical Report

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3.07 GRADING

A. Site Grading: Shape and finish earthwork to bring the site to the finish grades and elevations shown on the drawings.

1. Establish grades by means of grade stakes placed at corners of units, at abrupt changes of grade, and elsewhere as may be required.
2. Rough grade for paving, and site improvements to the subgrade elevations required. Soft and unstable material which will not readily compact when rolled or tamped shall be removed and the resulting depressions filled with stable material and re-compacted.
3. Finish grade to the finish contours and spot grades shown. Extend cuts and fills to feather out beyond the last finish contour or spot grade shown. Grade to uniform levels and slopes between points for which elevations are given, round off abrupt changes in elevation, and finish off smoothly. Finish grades shall slope away from the building in all directions to assure proper drainage.
4. Execute erosion control measures in accordance with the Erosion Control Plan.

B. Grading Around Trees: Where grading is required within the branch spread of trees that are to remain, perform the work as follows:

1. When trenching occurs, the tree roots shall not be cut but the trench shall be tunneled under or around the roots by hand digging.
2. When the existing grade at a tree is below the new finished grade, and fill not exceeding 6" is required, clean washed gravel graded from 1" to 2" size shall be placed directly around the tree trunk. The gravel shall extend out from trunk on all sides a minimum of 18" and finish approximately 2" above the finished grade at the tree. Install gravel before earth fill is placed.
3. Trees in areas where the new finished grade is to be lowered shall have re-grading work done by hand to elevation as indicated. Existing grades immediately surrounding the trunk shall not be altered except at the direction of the Architect.

3.08 PROTECTION, CLEAN-UP AND EXCESS MATERIALS

A. Protect grades from construction and weather damage, washing, erosion and rutting, and repair such damage that occurs.

B. Correct any settlement below established grades to prevent ponding of water.

C. At locations where concrete or other foreign matter has penetrated or been mixed with earth, remove damaged earth and replace with clean material.

D. Remove excess stockpiled material, debris, waste, and other material from site and leave work in clean finished condition for final acceptance. Contractor is responsible for disposal of debris and excess materials.

3.09 FIELD QUALITY CONTROL

A. Compaction Tests: Field density testing shall be performed by an Independent Testing Laboratory.

1. Testing laboratory shall make one in place density test for each 5,000 sq. ft. of area per lift in general site and paving areas and one test per 100 linear feet of drive lanes, but in no case less than two tests to ensure that the specified density is obtained. In sidewalk areas, laboratory shall make one in place density test per 100 liner feet.
2. The cost of the full-time inspection service shall be per Specification SECTION 01 4516 – CONTRACTOR'S QUALITY CONTROL.

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3.10 CONSTRUCTION STAKING

A. All drives must be staked using the profiles provided in the plans in addition to the grading and dimensional control plans. The contractor shall stake all vertical curves and points of grade break in order to achieve a smooth and uniform grade throughout. Verify all grades and elevations to confirm that ADA parking spaces, walks and ramps are per plans.

END OF SECTION

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SECTION 31 1000
SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supply General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Section Includes: Clearing the site of vegetation, site improvements and obstructions to make way for new work.

B. Related Sections

1. Section 31 0000 - Earthwork.

1.03 PROJECT CONDITIONS

A. Existing Conditions: Site is generally vacant, covered with some trees and native vegetation. Contractor shall visit the site and verify the nature and extent of clearing work required.

B. Protection: Contractor shall be responsible for the protection of adjoining property and improvements outside the limits of the work. Protect paving and utilities from damage by equipment and trucks.

C. It shall be the responsibility of the Contractor to obtain a temporary water meter and temporary sanitary sewer facilities for use during construction.

D. Contractor shall exercise care during operations to confine dust to the immediate work area and shall employ dust control measures to ensure adequate dust control throughout demolition and construction operations.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable building code for disposal of debris.

B. Coordinate clearing Work with previous owner and utility companies.

C. Conform to applicable portions of OSHA, including 1926.604.

PART 2 - PRODUCTS

Not Applicable.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that existing plant life and features designated to remain are tagged or identified

B. Locate and identify all paving and utilities intended to remain. Contractor shall field verify and coordinate with Owner and respective facility owner the location and depth of existing active facilities/ utility lines within the construction limits and shall protect all such facilities from damage during construction operations. Damage to existing facilities to remain shall be repaired at the Contractor’s expense for re-establishing the facilities to their pre-damaged condition.

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3.02 PERFORMANCE

A. Clearing:
   1. Remove trees, shrubs and other vegetation from within the area of the site where new construction is to be placed. Grub out roots to a depth of at least 18 inches below natural grade
   2. Dig out and remove buried obstructions to a depth of 24 inches below natural grade or 24 inches below the intended excavation elevation, whichever is lower. (Refer to landscape architect's plans and specifications)
   3. Remove existing trash, debris and abandoned facilities, which are to be removed from the site.
   4. Refer to SECTION 01 1100 - SUMMARY OF WORK for handling of piping and conduit encountered below grade.
   5. Clear undergrowth and deadwood, without disturbing subsoil.
   6. Burning debris on site is not permitted.
   7. Remove debris, rock, fences, and extracted plant life from site.

B. Reference landscape plans and specifications for limits for tree removal and pruning/trimming limits.

C. Disposal:
   1. Clean up and remove from the site the stumps, logs, broken paving, rubble and debris resulting from the clearing and grubbing operations.
   2. Remove all traces of demolished items from the site work area and rough grade all areas that have been disturbed.
   3. Material to be wasted shall be legally disposed of off site, at no additional cost to Owner.
   4. Burning of combustible materials on the site will not be permitted.

3.03 TOPSOIL EXCAVATION

A. Excavate topsoil from areas to be further excavated, re-landscaped, or regraded.

B. Stockpile in a preapproved area on or near the site. Install erosion control around perimeter of stockpile.

C. Reference landscape architectural plans and specifications for additional top soil requirements.

END OF SECTION

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SECTION 312310
BUILDING EXCAVATION AND FILL

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work included: Excavate, backfill, compact, and grade for the building to the elevations shown on the Drawings, as specified herein, and as needed to meet the requirements of the construction shown in the Contract Documents.

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.
   2. Section 00 3132 – Geotechnical Data.
   3. Section 01 4000 – Quality Requirements.

1.02 QUALITY ASSURANCE

A. Contractor shall ensure all bid and proposal documents and contracts include, if applicable to their trade, all required information related to trench excavation and working safety in compliance with Texas Health and Safety Code 756.021.

B. Use adequate numbers of skilled workers 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.

C. Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.

D. In addition to complying with requirements of governmental agencies have jurisdiction, comply with the directions of the Geotechnical Engineer.

1.03 PRODUCT HANDLING

A. Comply with pertinent provisions of Supplementary Conditions.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. Provide fill as indicated on the Drawing Sheets prepared by the various design professionals on the project.

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

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.

3.02 FINISH ELEVATIONS AND LINES

A. Finish grades shall be as shown on the site plan and shall form straight lines of slope between elevation markings.

3.03 PROCEDURES

A. Utilities:
   1. Unless shown to be removed, protect active utility lines shown on the Drawings or other wise made known to the Contractor prior to excavating. If damaged, repair or replace at no additional cost to the Owner.
   2. If active utility lines are encountered, and are not shown on the Drawings or otherwise made known to the Contractor, promptly take necessary steps to assure that service is not interrupted.

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3. If service is interrupted as a result of work under this Section, immediately restore service by repairing the damaged utility at no additional cost to the Owner.
4. If existing utilities are found to interfere with the permanent facilities being constructed under this Section, immediately notify the Architect and secure his instructions.
5. Do not proceed with permanent relocation of utilities until written instructions are received from the Architect.

B. Protection of persons and property:
1. Barricade open holes and depressions occurring as part of the Work, and post warning lights on property adjacent to or with public access.
2. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, washout, and other hazards created by operations under this Section.

C. De-watering:
1. Remove all water, including rain water, encountered during trench and sub-structure work to an approved location by pumps, drains, and other approved methods.
2. Keep excavations and site construction area free from water.
3. Use means necessary to prevent dust becoming a nuisance to the public, to neighbors, and to other work being performed on or near the site.

D. Maintain access to adjacent areas at all times.

3.04 EXCAVATING

A. Perform excavating of every type of material encountered within the limits of the Work to the lines, grades, and elevations indicated and specified herein.

B. Surplus material:
1. Dispose of unsatisfactory excavated material, and surplus satisfactory excavated material, away from the Project site.

C. Unauthorized excavation:
1. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific instruction from the Architect or the Geotechnical Engineer.
2. Under footings, foundations, or retaining walls:
   a. Fill unauthorized excavations by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering the required top elevation.
   b. When acceptable to the Geotechnical Engineer, lean concrete fill may be used to bring the bottom elevation to proper position.
3. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations, unless otherwise directed by the Geotechnical Engineer.

D. Stability of excavations:
1. Slope sides in accordance with OSHA requirements. For proposal purposes, proposers shall assume 1.5H:1V maximum slope. Steeper slopes are permitted only when allowed by OSHA or the Geotechnical Engineer. Calculations and drawings sealed by an Engineer licensed in the State of Texas, shall be submitted to the Architect and Engineer for design of any alternative excavation protection systems.
2. Shore and brace where sloping is not possible because of space restrictions or stability of the materials being excavated.
3. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

E. Shoring and bracing:

1. Provide materials for shoring and bracing as may be necessary for safety of personnel, protection of work, and compliance with requirements of governmental agencies having jurisdiction.
2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open.
3. Carry shoring and bracing down as excavation progresses.

F. Excavating for structures:
1. Conform to elevations and dimensions shown within a tolerance of 0.10 ft., and extending a sufficient distance from footings and foundations to permit placing and removing concrete formwork, installation of services, other construction required, and for inspection.
2. In excavating for footings and foundations, take care not to disturb bottom of excavation:
a. Excavate by hand tools to final grade just before concrete is placed.
b. Trim bottoms to required lines and grades to leave solid base to receive concrete.
c. Where continuous or spot footings are shown to be bearing on the soil, compact the bottom of the footing as noted in Paragraph 3.06 of this Section. Trenches and foundation holes shall be dry and free of water when concrete is placed.
3. Excavate for footings and foundations only after general site excavating, filling, and grading are complete.

3.05 FILLING AND BACKFILLING

A. General:
1. For each classification listed below, place acceptable soil material in layers to required sub-grade elevations. Provide fill and backfill as indicated on the Drawing Sheets prepared by the various design professionals on the project.

B. Backfill excavations as promptly as progress of the Work permits, but not until completion of the following.
1. Acceptance of construction below finish grade including, where applicable, dampproofing and waterproofing.
2. Inspecting, testing, approving, and recording locations of underground utilities.
3. Removing concrete formwork.
4. Removing shoring and bracing, and backfilling of voids with satisfactory materials.
5. Removing trash and debris.
6. Placement of horizontal bracing on horizontally supported walls.

C. Placing and compacting:
1. Place backfill and fill materials in layers not more than 8" in loose depth.
2. Before compacting, moisten or aerate each layer as necessary to provide the optimum moisture content.
3. Compact each layer to required percentage of maximum density for area.
4. Do not place backfill or fill material on surfaces that are muddy, frozen, or containing frost or ice.
5. Place backfill and fill materials evenly adjacent to structures, to required elevations.
6. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.
7. Where the construction includes basement or other underground walls having structural floors over them, do not backfill such walls until the structural floors are in place and have attained sufficient strength to support the walls.

3.06 COMPACTING

A. Compact the soil within the building lines as indicated in the Structural drawings and the geotechnical report. If there are any discrepancies, the Contractor shall compact to the most stringent case of these.

B. Control soil compaction during construction outside building lines to provide the minimum percentage of density specified for each area as determined according to ASTM D698 Standard Proctor Density.

3.07 FIELD QUALITY CONTROL

A. An Special Inspection and Testing Agency (SITA) will perform field quality control tests and inspections, as specified in Section 01 4533.

3.08 MAINTENANCE

A. Protect newly graded areas.

B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

PART 4 – TRENCHING REQUIREMENTS

4.01 GENERAL

A. These requirements shall be used for all trench excavations deeper than five (5) feet. The excavating and trenching operation manual of OSHA, Subpart B (latest edition) shall be the minimum governing requirement of this item and is hereby made a part of this specification.

1. Banks more than 5 feet high shall be shored, laid back to a stable slope, or some other equivalent means of protection shall be provided where employees may be exposed to moving ground or cave-ins. Refer to Table P-1 as a guide sloping of banks. Trenches less than 5 feet in depth shall also be effectively protected when examination of the ground indicates hazardous ground movement may be expected.
2. Sides of trenches in unstable or soft material, 5 feet or more in depth, shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect the employees working within them. See Table P-1, P-2 (following paragraph (l) of this section.)
3. Sides of trenches in hard or compact soil, including embankments, shall be shored or otherwise supported when the trench is more than 5 feet in depth and 8 feet or more in length. In lieu of shoring, the sides of the trench above the 5-foot level may be sloped to preclude collapse, but shall not be steeper than a 1-foot rise to each 1/2-foot horizontal. When the outside diameter of a pipe is greater than 6 feet, a bench of 4-foot minimum shall be provided at the toe of the sloped portion.
4. Materials used for sheeting and sheet piling, bracing, shoring, and underpinning, shall be in good serviceable condition, and timbers used shall be sound and free from large or loose knots, and shall be designed and installed so as to be effective to the bottom of the excavation.
5. Additional precautions by way of shoring and bracing shall be taken to prevent slides or cave-ins when excavations or trenches are made in locations adjacent to backfilled excavations, or where excavations are subjected to vibrations from railroad or highway traffic, the operation of machinery, or any other source.
6. Employees entering bell-bottom pier holes shall be protected by the installation of a removable-type casing of sufficient strength to resist shifting of the surrounding earth. Such temporary protection shall be provided for the full depth of that part of each pier hole which is above the bell. A lifeline, suitable for instant rescue and securely fastened to a shoulder harness, shall be worn by each employee entering the shafts. This lifeline shall be individually manned and separate from any line used to remove materials excavated from the bell footing.
7. Minimum requirements for trench timbering shall be in accordance with Table P-2.
8. Braces and diagonal shores in a wood shoring system shall not be subjected to compressive stress in excess of values given by the following formula:
   a. S=3-20L/D
   b. Maximum ratio L/D=50

c. Where: L= Length, unsupported, in inches.
d. D= Least side of the timber in inches.
e. S= Allowable stress in pounds per square inch of cross-section.

9. When employees are required to be in trenches 4 feet deep or more, an adequate means of exit, such as a ladder or steps shall be provided and located so as to require no more than 25 feet of lateral travel.
10. Bracing or shoring of trenches shall be carried along with the excavation.
11. Cross braces or trench jacks shall be placed in true horizontal position, be spaced vertically, and be secured to prevent sliding, falling, or kickouts.
12. Portable trench boxes or sliding trench shields may be used for the protection of personnel in lieu of a shoring system or sloping. Where such trench boxes or shields are used, they shall be designed, constructed, and maintained in a manner which will provide protection equal to or greater than the sheeting or shoring required for the trench.
13. Backfilling and removal of trench supports shall progress together from the bottom of the trench.
14. Jacks or braces shall be released slowly and, in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.

B. Definitions applicable to this subpart:
1. "Accepted engineering requirements (or practices)" - Those requirements or practices which are compatible with standards required by a registered architect, a registered professional engineer, or other duly licensed or recognized authority.
2. "Angle of repose" - The greatest angle above the horizontal plane at which a material will lie without sliding.
3. "Bank" - A mass of soil rising above a digging level.
4. "Belled excavation" - A part of a shaft or footing excavation, usually near the bottom and bell-shaped; i.e., an enlargement of the cross section above.
5. "Braces (trench)" - The horizontal members of the shoring system whose ends bear against the uprights or stringers.
6. "Excavation" - Any manmade cavity or depression in the earth's surface, including its sides, walls, or faces, formed by earth removal and producing unsupported earth conditions by reasons of the excavation. If installed forms or similar structures reduce the depth-to-width relationship, an excavation may become a trench.
7. "Faces" - See paragraph (k) of this section.
8. "Hard compact soil" - All earth materials not classified as running or unstable.
9. "Kickouts" - Accidental release or failure of a shore or brace.
10. "Sheet pile" - A pile, or sheeting, that may form one of a continuous interlocking line, or a row of timber, concrete, or steel piles, driven in close contact to provide a tight wall to resist the lateral pressure of water, adjacent earth, or other materials.
11. "Sides", "Walls", or "Faces" - The vertical or inclined earth surfaces formed as a result of excavation work.
12. "Slope" - The angle with the horizontal at which a particular earth material will stand indefinitely without movement.
13. "Stringers" (wales) - The horizontal members of a shoring system whose sides bear against the uprights or earth.
14. "Trench" - A narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench is not greater than 15 feet.
15. "Trench jack" - Screw or hydraulic type jacks used as cross bracing in a trench shoring system.
16. "Trench shield" - A shoring system composed of steel plates and bracing, welded or bolted together, which support the walls of a trench from the ground level to the trench bottom and which can be moved along as work progresses.

17. "Unstable soil" - Earth material, other than running, that because of its nature or the influence of related conditions, cannot be depended upon to remain in place without extra support, such as would be furnished by a system of shoring.
18. "Uprights" - The vertical members of a shoring system.
19. "Wales" - See paragraph (m) of this section.
20. "Walls" - See paragraph (k) of this section.

END OF SECTION

SECTION 312333
TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Work Included:
   1. Excavation for piped utility material.
   2. Provide necessary sheeting, shoring, and bracing.
   3. Comply with Federal, State, and local trench safety requirements.
   4. Prepare trench bottom with appropriate materials.
   5. Dewater excavation as required.
   6. Place and compact granular beds, as required, and backfill.

B. Related Work Specified in Other Sections
   1. Section 31 0000 – Earthwork
   2. Section 31 1000 – Site Clearing
   3. Section 33 1000 – Water Utilities
   4. Section 33 3000 – Sanitary Sewerage Utilities
   5. Section 33 4000 – Storm Drainage Utilities

1.03 PRECAUTIONS

A. Contractor shall determine the exact location of all utilities prior to construction.

B. Notify all utility companies when necessary to disturb existing facilities and abide by their requirements for repairing and replacing.

C. Protect all vegetation and other features to remain.

D. Protect all benchmarks and survey points.

1.04 COORDINATION

A. Where the specifications conflict with the City/County Water and Sewer Specification and City/County Standard Details for water and sewer construction, the Details and Specifications shall govern in that order.

PART 2 - PRODUCTS

2.01 BEDDING AND BACKFILL MATERIALS (ASTM D2487)

A. Reference Sitework Details and City/County Standard Specifications. Reference site drainage plan and NCTCOG Specification for storm drainage.

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PART 3 - EXECUTION

3.01 PREPARATION

A. Install barriers and other devices to protect areas adjacent to construction and to provide for public safety.

B. Protect and maintain all benchmarks and other survey points.

3.02 EXCAVATION TRENCHES

A. Perform in such a manner as to form a suitable trench in which to place the pipe and so as to cause the least inconvenience to the public.

B. Maximum width at the crown of the pipe shall be sixteen (16") inches plus the bell diameter of the pipe, unless approved specifically by the engineer due to unusual bracing and shoring requirements. The minimum width at the crown at the pipe shall be one foot plus the pipe bell diameter.

C. Cut pavement along neat straight lines with either a pavement breaker or pavement saw.

D. Trench Depth: For water lines - sufficient to provide minimum cover of 42 inches over the top of the pipe; for sewer lines and storm drain lines - as shown on the plans or as specified.

E. Align trench as shown on the plans unless a change is necessary to miss an unforeseen obstruction. Should such a change be necessary, the as-built information shall be provided to the engineer and it shall be approved by the engineer.

F. For water pipe, the trench shall be cut six (6") inches below the bottom of the pipe. The pipe shall be embedded in six (6") inches of granular material all around.

G. For sewer pipe, excavate six (6") inches below the bottom of pipe and fill the bottom of the trench with crushed stone or as specified by the City/County Standard Water & Sewer Specifications.

H. Trenches for storm drainage pipe shall be excavated and backfilled as shown on the plans.

I. When unsuitable soil is encountered at the trench bottom, remove it to a depth required to assure support of the pipeline and backfill to the proper grade with coarse aggregate AASHTO M-43, Size No. 2 or 3.

J. Remove rock encountered in trench excavation to a depth of six (6") inches below the bottom of the pipe barrel, backfill with an approved material, and compact to uniformly support the pipe. In no cases shall solid rock exist within six (6") inches of the finished pipeline.

K. When rock borings or soundings are provided, they are for information only and do not guarantee existing conditions. Make such investigations as deemed necessary to determine existing conditions. All trench excavation shall be considered “unclassified excavation”, with no additional compensation.

3.03 SHEETING, SHORING AND BRACING

A. All trench excavation shall be in accordance with OSHA Regulations and Texas State law.

3.04 USE OF EXPLOSIVES

A. The use of explosives on this project is strictly prohibited.

3.05 DISPOSAL OF EXCAVATED MATERIAL

A. All excess excavated material that cannot be used, or is not suitable, shall be disposed of in a manner acceptable to the Architect, at no additional cost to owner.

3.06 UNAUTHORIZED EXCAVATION

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A. No excavation outside or below the proposed lines and grades shown on the plans shall be provided unless approved by the Architect / Engineer.

B. Backfill areas of unauthorized excavation with the type material necessary (earth, rock or concrete) to ensure the stability of the structure or construction involved.

3.07 REMOVAL OF WATER

A. Keep excavated areas free of water while work is in progress.

B. Take particular precautions to prevent the displacement of structures or pipelines as a result of accumulated water.

C. Discharge from dewatering activities shall not be made to any sanitary sewer system unless approved by the system operator.

3.08 OBSTRUCTIONS

A. Obstructions shown on the plans are for information only and do not guarantee their exact locations nor that other obstructions are not present. The contractor shall determine and verify the exact location of all obstructions and utilities prior to construction.

B. When utilities or obstructions are not shown on the plans but are present off the roadway at the location of the proposed pipeline route, the contractor may request to relocate the pipeline at no additional cost to the Owner in the roadway if necessary to avoid disturbing the utility or obstructions.

E. Exercise due care in excavating adjacent to existing obstructions and do not disturb same.

D. In the event obstructions are disturbed, repair or replace as quickly as possible to the condition existing prior to their disturbance. The repair or replacement shall be at no cost to the Owner.

E. If desired by the utility company, pay for the repair or replacement work performed by the forces of the utility company or other appropriate party.

F. If replacement or repair of disturbed obstructions is not performed after a reasonable period of time, the Owner may have the necessary work done and deduct the cost of same from payments to the contractor.

3.09 STORM SEWER BEDDING

A. Bedding for RCP/HDPE storm sewers shall be as specified in Section 501.6, 504 and 504.2.1 thru 504.2.3 of Standard Specifications for Public Works Construction, NCTCOG and site details.

3.10 GRAVITY SANITARY SEWER BEDDING

A. Always maintain proper grade and alignment during the bedding and tamping process.

1. Any pipe dislodged during this process shall be replaced by the contractor at his expense.
2. Dig bell holes to assure uniform support of the pipe.
3. All bedding shall be tamped to a minimum of 95% maximum dry density.

B. Bedding for PVC Sewers:

1. Refer to Sitework Details and Standard Water and Sewer Specifications.
2. Lay sewer line on six inch (6") bed of crushed stone. Place granular material to a point twelve inches (12") above top of pipe.

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3.11 BEDDING FOR WATER LINES

A. The water line shall be bedded on six (6") inches of granular material in accordance with City/County Water and Sewer Specifications. Compact granular material to a point six inches (6") above the top of pipe.

B. Dig bell holes to assure uniform support throughout the entire length of pipe.

3.12 INITIAL BACKFILLING

A. Do not begin backfilling before checking/inspecting the grade and alignment of the pipe, the bedding of the pipe, and the joints between the pipe. If backfill material is placed over the pipe before an inspection is made, reopen the trench in order for an inspection to be made.

B. Perform backfilling by hand, together with tamping, until fill has progressed to the top of specified embedment above the pipe.

1. Deposit appropriate material free from lumps, clods, frozen material or stones in layers approximately eight (8") inches thick.
2. Compact by hand, or with manually operated machine tampers actuated by compressed air or other suitable means.
3. Use tamps and machines of a suitable type which do not crush or otherwise damage the pipe.

3.13 FINAL BACKFILLING

A. After placement of the granular embedment material has been achieved, perform final backfilling depending upon the location of the work and danger from subsequent settlement.

B. Backfilling beneath existing or proposed driveways, streets, sidewalks, parking areas or any paved area:

1. Backfill trenches per Geotechnical Report.
2. Carefully deposit in uniform layers, not to exceed six (6") inches thick.
3. Compact each layer by rolling, ramming and tamping with tools suitable for that purpose in such a manner so as to not disturb the pipe.
4. At 200' intervals in the trench, clay check dams shall be installed to inhibit the piping of surface and/or subsurface water. The contractor shall compact full depth two foot (2') clay check dams at each location the trench enters or exits a pavement.
5. Jetting or ponding of native material backfill will not be allowed.

3.14 FIELD QUALITY CONTROL

A. Compaction Tests: Field density testing of the completed trench backfill shall be performed by an Independent Testing Laboratory.

1. The Laboratory shall make one density test for each 150 linear feet of trench, with a minimum of 1 test per lift.

END OF SECTION

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SECTION 313116
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; 2022.

1.03 SUBMITTALS

A. See Section 013000 - 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 017800 - 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.

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.

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D. Manufacturers:
   1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management.
   2. Control Solutions, Inc.; Taurus SC: www.controlsolutionsinc.com.
   3. FMC Professional Solutions: www.fmcprosolutions.com.
   4. Syngenta Professional Products: www.syngentaprofessionalproducts.com.
   5. Termiticide/Termidor HE or SE by Termidor Termite Defense: www.termidorhome.com
   6. Substitutions: See Section 016000 - 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.

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

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SECTION 31 3200
SOIL STABILIZATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Section Includes: In-place cement treatment to stabilize the subgrade under concrete and asphaltic concrete pavement, and concrete walks, which parallel drives.

B. Related Sections:

1. Section 01 4516 – Contractor's Quality Control
2. Section 31 0000 – Earthwork
3. Section 32 1313 – Concrete Paving

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D 698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3).

B. Geotechnical Report

C. TxDOT - Standard Specifications for Construction of Highways, Streets and Bridges, Texas Dept. of Highways and Public Transportation, as amended.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cement - Stabilization for Paving Subgrade

1. Per TxDOT Item 275.

B. Soil: Upper 6" of the material in-place after the subgrade has been established, compacted, and shaped.

C. Cement: Portland cement content a minimum 8% by weight at 40 lbs per SY.

2.02 EQUIPMENT

A. Distributor truck or tank equipped with agitator to maintain a uniform mixture of cement.

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PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure that surfaces have been brought to approximate rough grades (plus or minus 0.10 feet). Loosen and pulverize soil to a depth of 6 inches below bottom of designated paving or slab areas, including a distance of 24" outside perimeter of paving and 12” past sidewalk per the plans.

3.02 PERFORMANCE - PAVING SUBGRADE

A. General: It is the primary requirement to secure a completed 6” deep subgrade of treated material containing a uniform cement mixture, free of loose areas, of uniform density and moisture content, well bound for its full depth and with a smooth surface suitable for placing subsequent paving and slabs. Construction methods and equipment shall comply to TxDOT Item 275.

B. Scarification: Excavate and scarify the material to be treated down to the secondary grade (proposed bottom of cement treatment). Wet or unstable material below the secondary grade shall be corrected by scarifying, adding cement and compacting to uniform stability. Then spread the excavated and scarified material to the desired cross-section. Full depth of treatment shall be 6 inches and full width shall be the entire area to be paved between points and lines located a minimum of 24" beyond pavement edges and 12” beyond sidewalk edge or per the plans, whichever is greater.

C. Placing Cement: Add cement to the scarified material in an amount equal to 40 lbs. per sq. yd. of 6” depth of compacted subgrade. Apply cement mixed and blended with upper 6 inches of the subgrade. Spread cement only on that area where mixing operations can be completed during the same working day.

D. Mixing: Mix the soil and cement thoroughly with suitable road mixers or other approved equipment until a homogeneous, friable mixture is obtained free from clods and lumps. Aerate or sprinkle the mixture as necessary to secure the optimum moisture content. Necessary optimum moisture content shall be at or above the optimum.

E. Compacting: Sprinkle the mixture as required and compact by rolling and tamping to a minimum of 95% standard density, ASTM D698. Correct irregularities and weak spots by scarifying, adding or removing material, and re-shaping and re-compacting. Maintain the surface of the subgrade smooth, free from undulations and ruts, and to the established lines and grades.

F. Curing: Allow the mixture to cure for a minimum of 72 hours. During the curing period keep the material moist. During this time, the section shall not be opened to vehicular traffic.

3.03 FIELD QUALITY CONTROL

A. Compaction Tests: Field density testing of the completed stabilized subgrade under paving shall be performed by an Independent Testing Laboratory.

1. The Laboratory shall make one density test for each 5,000 sq. ft. of stabilized subgrade in paving areas and one test per 150 liner feet of drives to ensure that the specified density is obtained.

END OF SECTION

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SECTION 321313
CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Section Includes: New concrete walks, curbs and gutters, paving, approaches, and other concrete flatwork outside the building.

B. Related Sections:

1. Section 31 0000 - Earthwork

1.03 REFERENCES

A. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

B. ACI 305 - Recommended Practices for Hot Weather Concreting.

C. ACI 306 Recommended Practices for Cold Weather Concreting.

D. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

E. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

F. ASTM C309, Type II – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

G. NCTCOG - Standard Specifications for Public Works Construction.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Obtain materials from same source throughout.

C. City Standards: Street sidewalks, curbs and gutters, and approaches shall be constructed to meet or exceed the requirements of the City standard specifications (or NCTCOG) where the City standards are applicable.

1.05 SUBMITTALS

A. Product Data: Submit concrete mix designs in accordance with SECTION 01 3323 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Include data on joint filler, admixtures and curing compounds.

C. Submit manufacturer's instructions under provisions of SECTION 01 3323 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

D. Confirm proposed joint layout shown on plans; submit revised layout for approval prior to starting work.

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1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not place pavement when base surface or ambient temperature is less than 40 degrees F, or if base surface is wet or frozen.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cements: ASTM C 150, Type I, domestic manufacture.

B. Fly Ash: ASTM C 618, Class F or C.

C. Fine Aggregate: ASTM C 33, washed sand with a fineness modulus of between 2.50-3.00.

D. Coarse Aggregate: ASTM C 33, clean crushed stone or washed gravel. The nominal maximum particle size shall not exceed 1/5 of the narrowest dimension between forms or ¾ of the minimum clear spacing between reinforcing bars.

E. Admixture: ASTM C 494, Types "A", "D" and "E", water reducing, chloride-free admixture.

F. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

G. Water: ASTM C 94, Clean and potable.

H. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

I. Formwork:

1. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
2. Use flexible or curved forms for curves of a radius 100 feet or less.
3. Use forms of size and strength to resist movement during concrete placement.
4. 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.

J. Reinforcement:

1. Reinforcement Bars: ASTM A 615, Grade 60, deformed.
2. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs. Provide with closed sleeves at one end to allow one inch movement.
3. Tie Bars: ASTM A 615, Grade 60, deformed.
4. Bar Supports: chairs for spacing, supporting, and fastening reinforcement bars, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from plastic to support bars at the proper depth per the details.

K. Concrete shall meet the requirements specified in plans and specification. Paving and 5” flatwork shall be 6 sack of cement content per cubic yard with a minimum compressive strength of 4000 psi at 28 days and 3000 psi at 28 days for 4” flatwork. (Entrained Air: 3-6%, Slump: 4-6 inches, Fly Ash Replacement – 20% max).

L. Expansion Joint Filler:

1. ASTM D 1751 preformed strips of asphalt saturated cane fiberboard for joints in standard finished flatwork (walks, curbs and gutters).
2. ASTM D 1752, Type I preformed strips of elastic sponge rubber compound for joints to be caulked with sealant and joints in architectural concrete flatwork.
3. The use of redwood expansion joints is prohibited.

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M. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

Product manufacturer; one of the following:

Crafco Inc.; RoadSaver Silicone SL.

Dow; DOWSIL 890-SL

N. Joint Sealant Backer Rod:

1. Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
2. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.02 MIXING AND DELIVERY

A. Measurement of concrete materials, mixing, and delivery of fresh concrete to the project shall meet the requirements of ASTM C 94. Transit-mixed concrete supplier shall have a plant with sufficient capacity and transportation facilities to assure continuous delivery at the rate required.

B. Mix concrete in accordance with ASTM C94, Alternative No. 2, or ACI 304.

C. Deliver concrete in accordance with ASTM C94.

D. Select proportions for normal weight concrete in accordance with ACI 301 Method 1. Mix not less than one minute after materials are in mixer.

E. Do not transport or use concrete after 90 minutes has expired from time of initial mixing.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify compacted subgrade is ready to support paving and imposed loads, free of frost, smooth and properly compacted.

B. Verify gradients and elevations of base are correct, and proper drainage has been provided so that water does not stand in the area to receive paving.

C. Beginning of installation means acceptance of existing conditions.

3.02 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Notify Architect, Owner, and testing laboratory, minimum 24 hours prior to commencement of concreting operations.

C. Grade Control: Establish and maintain the lines and grades for concrete site work items by means of line and grade stakes. Complete any fine grading required to prepare the subgrade. Maintain the finished subgrade cushions in a satisfactory condition.

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3.03 INSERTS AND ACCESSORIES

A. Make provisions for installation of inserts, accessories, anchors, and sleeves.

3.04 INSTALLATION

A. Forming: Set forms to lines and grades, and brace and secure to withstand wet concrete without deflection or leakage. Stake forms securely in position with joints keyed to prevent relative displacement. Clean and oil forms each time they are used. Refer to Section 03 1100 for additional installation requirements.

1. Walks: 4" and 5” thick. Surfaces shall be crowned or sloped to drain.
2. Curbs and Gutters: As detailed.
3. Paving, Drive Approaches: Thicken edges as required.
   a. 6” thick – Light-Duty Parking Areas (Parking Areas and Drive Aisles)
   b. 7" thick – Heavy-Duty Parking Areas (Drives, Bus Lanes and Fire Lanes)

B. Reinforcing: Install reinforcing to meet the requirements of SECTION 03 2000 - CONCRETE REINFORCEMENT. Where reinforcement is not specifically detailed, reinforce pavement with **#4 rebars at 18” o.c. each way.**

C. Concrete: Place concrete to meet the requirements of SECTION 03 3000 - CAST-IN-PLACE CONCRETE.

1. Place concrete in accordance with ACI 301 and 304. Deposit concrete so that specified slab thickness will be obtained with use of a vibratory screed and finishing operations. Minimize handling to prevent segregation. Consolidate concrete by suitable means to prevent formation of voids or honeycombs. Exercise care to prevent disturbance of forms and reinforcing and damage to vapor retarder. Place concrete to lines and levels shown, properly sloped to drain into adjacent yard areas or drainage structures. **Concrete shall be placed using a walk behind screed machine (Magic Screed). In addition, a backpack vibrator shall be used. A minimum of two (2) screed machines and backpack vibrators shall be present during all concrete pours.** The surface shall be troweled and edged with a steel trowel and then broomed to obtain a smooth, uniform brush finish.
2. Hot Weather Placement: ACI 305.
3. Cold Weather Placement: ACI 306.
4. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
5. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
6. **The Contractor shall not back over the steel at anytime while pouring concrete. Construction sequencing efforts shall be utilized in order to successfully make each concrete pour. If necessary, the Contractor shall utilize concrete pumping to perform the work.**

D. Expansion Joints: Locate expansion joints around fixed objects within or abutting concrete, and at intervals of not more than 35 ft. o.c. along walks and curbs and 150 ft. o.c. along drive and parking paving unless otherwise shown on the plans.

1. Install preformed filler with the top edge approximately 1/4" below the finished concrete surface to leave a neat, straight joint.
2. Joints shall be ½" wide unless specifically dimensioned otherwise on the drawings. Joint edges shall be rounded with an edging tool.
3. There shall be no connection by reinforcement or keyway across expansion joints. Joints shall be held in alignment with sleeved, smooth dowels where required.

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4. The use of redwood expansion joints is prohibited.

E. Scoring:

1. Saw cut walks, approaches, and paving using an abrasive or diamond blade. Cut joint width shall be 1/8" and depth shall be 1/4" deep at walks and 1/3 slab thickness at approaches and paving. Cutting of joints must be done as soon as concrete surface is firm enough not to be torn or damaged by the blade (within 4 to 12 hours), and before random shrinkage cracks can form in the concrete slab.
   a. Score walks at approximately 5-foot intervals each way. Score 4” flatwork at 5-foot intervals each way and 5” flatwork at 10-foot intervals each way.
   b. Score curbs and curbs and gutters at approximately 5-foot intervals.
   c. Score approaches and paving at 12 foot maximum intervals each way or as shown.

F. Standard Finishing: Strike slabs off true by double screeding to the required level at or below the elevations and grades shown on the drawings. Set edge forms and screed strips accurately to produce the designated elevations and contours.

1. Walks: Float with wood floats to true planes with no coarse aggregate visible. Hand trowel to produce smooth surfaces. Brush surfaces with a soft fiber brush to produce a uniformly striated finish. Edge concrete surfaces with a rounded edging tool.
2. Curbs and gutters: All curbs shall hand formed and finished. Cross brush surfaces with a soft fiber brush to produce a fine brush finish.
3. Approaches: Screed and float to a monolithic medium float finish and belt with a canvas belt to produce a herringbone texture finish.
   a. Curb Ramps: Provide tooled grooves with chemical staining of concrete as detailed (if required).

G. Curing:

1. Cure concrete 7 days. Coat exposed surfaces with curing compound, **white pigmented for paving and clear for flatwork,** and protect surfaces from pedestrian and vehicular traffic during the curing period. Damaged areas shall be re-sprayed. Curing compound shall conform to the specifications of ASTM C309, Type 2.
2. Removing Forms: Forms shall remain in place for at least 12 hours after concrete has been placed and finished. Remove forms without damaging the concrete. Bars and heavy tools shall not be used to pry against the concrete in removing the forms. Repair all honey combs. Backfill all curbs.

3.05 FIELD QUALITY CONTROL

A. Concrete Tests: Testing and acceptance of concrete shall meet the requirements specified in the plans and specifications and by the geotechnical firm.

B. Grade and Smoothness Tests:

1. Plan Grade: Finished surface of the flatwork shall not vary more than 0.04 ft. above or below the plan grade or elevation. Finished surfaces of abutting pavement and walks shall coincide at their juncture. Where a new pavement or walk abuts an existing surface, transition pavement or walk strip shall be installed.
2. Surface Smoothness: Finished surface of the flatwork shall have no abrupt changes of more than 1/8" and shall not deviate from the testing edge of a 12 ft. straight edge more than 1/4" plus or minus tolerance. Flow line of gutters shall not deviate from the testing edge of a 10 ft. straight edge more than 1/8" plus or minus tolerance.

C. Concrete Cracking:

Contractor is responsible for controlling all concrete cracking.

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1. **Pavement: If more than one (1) crack per panel occurs, the Contractor may be required to remove and replace the panel as directed by the Engineer or Owner.**
2. **Sidewalk and Flatwork: Where cracking occurs, Contractor to remove and replace entire panel.**

3.06 CLEANING

A. Remove debris, scraps, surplus materials, tools and equipment from the premises upon completion of the work. Clean concrete droppings from walks and curbs. Leave the graded areas free of debris and rubble.

3.07 PROTECTION

A. Immediately after placement, protect concrete under provisions of SECTION 01 5000 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. The pavement shall be closed to all traffic, including vehicles of the Contractor, until the concrete is at least 7 days old or has attained a minimum average of 3,000 psi compressive strength. Repair any damage to the pavement prior to the acceptance by Owner at no additional cost to the Owner. This does not relieve the Contractor from the normal liabilities, and maintenance responsibilities, implied or otherwise, for the pavement or other items.

END OF SECTION

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SECTION 323113
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary Conditions of the Contract, Division 1 – General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SCOPE

A . Section Includes: Galvanized steel chain link fences and gates. Contractor shall obtain chain link fences as complete units, including necessary erection accessories, fittings and fastenings from a single source or manufacturer.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. 0. ASTM A 153 – Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
2. ASTM A 392 – Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
3. ASTM A 446 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
4. ASTM A 569 – Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality.
5. ASTM A 641 – Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
6. ASTM A 824 – Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.
7. ASTM C 33 – Specification for Concrete Aggregates.
8. ASTM C 150 – Specification for Portland Cement.
9. ASTM F 567 – Practice for Installation of Chain-Link Fence.
10. ASTM F 669 – Specification for Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fence.
11. ASTM F 900 – Specification for Industrial and Commercial Swing Gates.
12. ASTM F 1083 – Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

B. Chain Link Fence Manufacturer's Institute (CLFMI) Publications:

1. Product Manual

1.04 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 3323 – SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include manufacturer's installation instructions.

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PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide chain link fences and gates as manufactured by one of the following:

American Fence Company

Wheatland Tube

Master Halco.

SPS Stephens Pipe & Steel

Merchants Metals

2.02 MATERIALS

A. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 12' high. All fencing shall have a knuckled selvage top and bottom. Wire size includes zinc coating.

1. Fabric sizes:

a. Fencing: 2-inch mesh, 0.148-inch diameter (9 gauge).

B. Galvanized Steel Finish: ASTM A 392, Class 1, with not less than 1.2 oz. Zinc per sq.ft. of uncoated wire surface.

C. Framing: Strength requirements for posts and rails shall comply with ASTM F 669.

D. Pipe shall be straight, true to section, material and sizes specified and shall conform to the following weights per foot:

NPS in Inches	Outside Diameter (OD) in inches	Type I Steel (lbs./ft.)
1 ¼	1.660	2.27
1 ½	1.900	2.72
2	2.375	3.65
2 ½	2.875	5.79
3 ½	4.000	9.11
6 ⅝	6.625	18.97

E. Steel Framework, General: Posts, rails, braces and gate frames.

1. Type I Pipe: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (schedule 40) with not less than 1.8 oz. zinc per sq. ft. of surface area coated.

F. End, corner and pull posts: Size as indicated on the plans.

G. Line or intermediate posts: Size as indicated on the plans.

H. Top Rail: Manufacturer's longest lengths, with expansion-type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

1. Galvanized Steel: 1 ¼" NPS (1.66" OD) Type I steel pipe.

I. Tension Wire: ASTM A 824, 0.177" diameter metallic-coated steel marcelled tension wire with finish to match fabric.

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J. Tie Wires: 0.148-inch diameter (9 gauge) galvanized steel or equal.

K. Post and Line Caps: Provide weathertight closure cap for each post. Provide line post caps with loop to receive tension wire or top rail.

L. Tension or Stretcher Bars: Hot-dip galvanized steel with minimum length 2" less than full height of fabric, minimum cross-section of 3/16" by ¾" and minimum 1.2 oz. zinc coating per sq. ft. of surface area. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into post.

M. Tension and Brace Bands: Minimum ¾" wide hot-dip galvanized steel with minimum 1.2 oz. zinc coating per sq. ft. of surface area.

1. Tension and Brace Bands: Minimum 12 gauge (0.105") thick.

N. Gates:

1. Gate frames shall be constructed of 2" o.d., Schedule 40 steel pipe secured at corners with malleable iron or pressed steel ells, riveted with four rivets per ell. Frame shall be hot-dip zinc coated after fabrication.
2. Welded gate frames are unacceptable.
3. Internal bracing shall be 3/8" diameter galvanized truss rods with tighteners.
4. Hinges shall be pressed steel or malleable iron. Bottom hinge shall be a ball and socket type. All gates shall allow for a one hundred eight (180˚) degree swing.
5. Gates shall be equipped with a heavy duty fork-type latch with lock keeper and lock keeper guide and as indicated on the plans.

O. Chain Link Double V-Track Sliding Gate (as manufactured by The Anchor Group or approved equal):

1. Perimeter gate frame shall be 3" square 11 gauge galvanized tubing.
2. Vertical members shall be 2" square 14 gauge galvanized tubing.
3. Chain link fabric shall be 9 gauge and attached to top and bottom truss rods with hog rings and at ends along with tension bars.
4. Provide adequate number of steel v-rollers with sealed bearings to support the gate span
5. Provide and install V-tracks on the concrete paving/pad.
6. Provide adequate posts with guide rollers for the sliding gate.
7. Provide appropriate sliding gate motor/operator for the gates shown on the plans. Provide concrete pad, required electrical, card readers, photo cell and safety loops and other appurtenances to provide full functioning system. Manufacturer shall be DoorKing or approved equal.

P. Fittings: All fittings to be hot-dip zinc coated shall be 1.2 ounces of zinc per square foot of coated area.

Q. Concrete Post Footings: All concrete used shall conform to Section 03 3000 – Cast-in-Place Concrete.

PART 3 - EXECUTION

3.03 INSTALLATION

A. General: Install fence in compliance with ASTM F 567. Do not begin installation and erection before final grading is completed.

B. Setting Posts: Center and align posts in holes 6" above bottom of excavation. Space maximum 10' o.c. unless otherwise noted on the plans. Protect portion of posts above ground from concrete splatter. Place concrete around posts and vibrate or tamp for

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consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations. Extend concrete footings 2” above grade and trowel to a crown to shed water.

C. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

D. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

E. Bottom Tension Wire: Install tension wire within 6” of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 11-gage hog rings of same material and finish as fabric wire, spaced maximum 24” o.c.

F. Tension or Stretcher Bars: Thread through or clamp to fabric 4” o.c., and secure to end, corner, pull and gate posts with tension bands spaced not over 15” o.c.

G. Tie Wires: Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

1. Maximum Spacing: Tie fabric to line posts 12” o.c. and to rails and braces 24” o.c.

H. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

I. Fabric: All fabric shall be placed on the inside of the baseball/softball fields, track, and tennis courts.

END OF SECTION

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SECTION 328400
PLANTING IRRIGATION_PERFORMANCE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope - Furnish and install an operating irrigation system complete and in place to include pipe, fittings, heads, valves, controller/junction box, pump system, wire and related accessories. The word "Contractor" when used alone shall refer to the irrigation contractor.

B. Contractor is hereby advised that a PERFORMANCE SPECIFICATION will be in place and that additional equipment, parts and labor shall be furnished as required to provide a proper and satisfactory irrigation system at no additional cost to the Owner.

C. Adhere to local permit and other requirements. All permits and fees shall be paid by Contractor.

D. Coordinate installation with other trades as necessary to prevent cutting, patching or re-routing.

1.02 RELATED WORK:

A. 329213 HYDROMULCHING

B. 329223 SOD

1.03 QUALITY ASSURANCE

A. Materials, Equipment, Installation
Materials, equipment, and installation shall comply with National Fire Protection Association (National Electrical Code), American Society for Testing and Materials, National Sanitation Foundation, Irrigation Association, and all applicable local codes and ordinances. Contractor shall have successfully completed and provide references of a minimum five projects of similar size and scope within the last five years under the same company name.

B. Licensing
Installation design, pricing and installation shall be made by a contractor licensed as an irrigator by the State of Texas. Skilled workmen shall be used who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this section.

C. Existing Features
Prior to beginning construction the contractor shall field locate all utilities and maintain their locations. Existing features designated to remain as part of landscape shall be protected. If the contractor causes any damage to existing conditions to remain, then the contractor shall bear the expense of repair.

D. Damage to Adjacent Facilities
Damage to adjacent facilities caused by irrigation system work shall be repaired promptly at contractor's expense.

E. Safety
Contractor shall maintain a safe working environment at all times.

F. The owner or Architect reserves the right to reject any or all work which does not comply with the plans and specifications. Rejected work shall be brought into compliance by the contractor at no additional cost to the owner.

G. Applicable Standards
ASTM-D2241-Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR)
ASTM-D2464-Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Threaded, Schedule 40
ASTM-D2466-Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Socket Type, Schedule 40

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ASTM-D2564-Solvent Cements for Poly Vinyl Chloride (PVC) pipe and fittings
ASTM-D2855-Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings

H. Contractor Responsibilities
The contractor shall give all necessary notices, file with all governmental departments having jurisdiction; obtain all required certificates of inspection for his work and deliver to the Architect before request of acceptance and final payment for work. Permit fees paid by owner, Permits obtained by Contractor.

I. The contractor shall at all times protect his work from damage and theft and replace all damaged or stolen parts at his expense until the work is accepted in writing by the Owner.

1.04 UNIT PRICES:

Provide unit prices for work and materials. Unit prices will be applied when greater or lesser amount of work is required. Unit prices are to be the cost of work and materials in place including materials, equipment, labor, taxes, overhead, guarantee, maintenance and profit.

1.05 REFERENCES:

ASTM - American Society for Testing Materials
D2241: Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).
D2287: Flexible Polyvinyl Chloride (PVC) Plastic Pipe.
D2464: Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Threaded, Schedule 80.
D2466: Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Socket Type, Schedule 40.
D2564: Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings.
D2855: Making Solvent - Cemented Joints for Polyvinyl Chloride (PVC) Plastic Pipe Fittings.

1.06 DEFINITIONS:

A. Irrigation Main: That portion of piping from water source to remote control valves. This portion of piping is subject to surges, being a closed portion of the irrigation system. Hydrant lines (QCV) are considered a part of the main line piping system.

B. Lateral Piping: That portion of piping from remote control valve to sprinkler heads and tubing.

1.07 SYSTEM DESCRIPTION:

Install to provide a complete coverage for lawn and planting areas within limits shown on Drawings. Furnish and install an operating system complete with electrical connection, main and lateral line piping, sprinkler heads, remote control valves, quick coupler valves, wire and any other items required for a complete and operating system.

1.08 SUBMITTALS:

A. Product Data: Manufacturer's literature in triplicate, neatly bound with cover titled with name and address of project, date of submission, and name and address of Owner, Landscape Architect and Contractor.

B. Irrigation Plan: Complete plan showing design water pressure, routing and sizing of piping, head placement, type and nozzle size, valve location and size, zone GPM, controller location and size, backflow preventer location and size, and material list indicating manufacturer and model number for each item. Design of system not to exceed manufacturer's requirements for spacing and GPM. Size piping not to exceed 5 F.P.S.

C. Project Record Documents:
1. Maintain at site one copy of Drawings, Specifications, Addenda, approved Change Orders and other modifications in good order and marked to record changes made during construction.
2. Upon completion of work, transpose changes to mylar sepia.

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3. Return sepia to Owner and Landscape Architect prior to issuance of final acceptance. Sepia to include location, by written dimension, of mainline piping, remote control valves and quick coupler valves. Title sepia “Record Drawing” and include date and signature and license of installer.

D. Provide three complete operation manuals and equipment brochures neatly bound in a hard back three-ring binder. Include any warranties and guarantees extended to the Contractor by the manufacturer of all equipment. Include three (3) executed copies of “Guarantee for Landscape Irrigation System”.

1.09 SAMPLES AND TESTS

A. Contractor shall test all non-potable irrigation water before applying it to any sod, seed, trees, shrubs, or other plant material. All irrigation water shall meet these standards:
1. Sodium Absorption Ratio (SAR) shall be less than 3.0
2. Electrical Conductivity (ECe) shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade.
3. Boron shall be less than 2 parts per million
4. Arsenic and Lead shall each be less than 0.1 parts per million
5. pH shall be between 6.0 and 7.5
6. Submit lab test results to Landscape Architect for review and possible adjustments to water.

1.010 GUARANTEE

A. The guarantee for the sprinkler irrigation system shall be made in accordance with the attached form. The general conditions and supplementary conditions of these specifications shall be filed with the Owner and the Landscape Architect prior to acceptance of the irrigation system.

B. A copy of the guarantee form shall be included in the operations and maintenance manual.

C. The guarantee form shall be re-typed onto the Contractor's letterhead and contain the following information:

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GUARANTEE FOR LANDSCAPE IRRIGATION SYSTEM

We hereby guarantee that the landscape irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse or neglect expected. We agree to repair or replace any defects in material or workmanship, which may develop, and to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a reasonable time, as determined by the Owner, after receipt of written notice. In the event of our failure to make such repairs or replacements within a reasonable time after receipt of written notice from the Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense. We will pay the costs and charges therefore upon demand.

PROJECT: _____

LOCATION: _____

_____

SIGNED: _____

COMPANY: _____

ADDRESS: _____

_____

_____

PHONE: (_____) _____ - _____

DATE OF ACCEPTANCE: _____ / _____ / _____

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1.10 PROJECT/SITE CONDITIONS:

A. Water Supply: Provide as indicated on Drawings. Owner will provide water for required testing, flushing and nozzling.

B. Sleeves and Ducts: Install as indicated on Drawings. Do not use as main nor lateral piping.

C. Existing Utilities and Structures: Consult with Owner and appropriate utility companies for location prior to commencing installation. Repair damage due to installation immediately. Make necessary adjustments in the layout as may be required to connect to existing stub outs, should such stub outs not be located or describes exactly as shown, and as may be required to work around existing conditions.

D. Storage: Space will be designated at the site.

E. Barricades: Barricade streets per local codes and regulations during installation.

F. Deliver materials in original package, cartons, and containers bearing the name of manufacturer, brand and model number.

G. Protect irrigation system materials before, during and after installation. Exercise care in handling, loading, unloading, coverings and storing plastic pipe and fittings until ready to install. Handle all material in an approved manner. No damage materials shall be used.

H. In the event of damage, immediately make repairs and replacements necessary at no additional cost to Owner.

1.11 SCHEDULING:

A. Coordinate with Landscape Contractor and other work.

B. Prepare a detailed schedule coordinated with the work of other contractors doing work at the site.

C. Monitor schedules on a regular basis so potential variances can be determined and resolved.

D. Verify all product orders so delivers are timed to maintain construction schedules.

1.12 MAINTENANCE:

A. Provide maintenance of system including cleaning and adjustment of heads, raising and lowering of heads, cleaning filters, flushing lateral lines and tubing for 60 days after final acceptance.

B. Repair backfill settlement of trenches and re-sod during 60 day period.

C. Drain and flush system within 60 day guarantee period.

D. Instruct Owner and Owner's personnel in operation and general maintenance of system. Provide Owner with a maintenance manual of materials installed bound in a three ring black vinyl binder.

E. Repair of damage caused by vandals, other contractors or weather conditions shall be considered extra to the work.

F. Maintain the entire irrigation system in proper workings order and program the controllers in consultation with Landscape Contractor during the installation and maintenance phase of the work prior to final acceptance.

G. Provide the Owner with a letter summarizing the warranty stated in this specification and date of final acceptance. This letter shall serve as the Contractor's written guarantee.

PART 2 - PRODUCTS

2.01 BACKFLOW PREVENTION UNITS:

A. Backflow prevention units shall be:

1. If new, of size and type indicated on the drawings. Install backflow prevention units in accordance with irrigation construction code requirements.
2. If existing, recertified as required by State law and municipal code if more than one (1) year in place

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B. Wye strainers at backflow prevention units shall have a bronzed, screwed body with 60 mesh monel screen and shall be similar to Bailey #100B, or approved equal.

2.02 POLY VINYL CHLORIDE PIPE:

A. As manufactured in accordance with standards noted herein:
1. Marking and Identification: Continuously and permanently marked with manufacturer's name, pipe size, pipe type and material, SDR number, ASTM standard number and NSF (National Sanitation Foundation) Seal.
2. Pipe Fittings: Of same material as PVC pipe specified and compatible with PVC pipe furnished.
3. PVC Pipe: Class 200, SDR 21, except one-half inch to be Class 315, SDR 13.5. Under paved surfaces and in sleeves to be Schedule 40.
4. Flexible PVC Pipe: Heavy duty flexible vinyl pipe as manufactured by Agricultural Products, Inc.
5. Sleeves: Class 200, SDR 21.

2.03 VALVE WIRING:

A. All wire shall be a minimum of Type UF, No. 14 gauge with 4/64 inch insulation, Underwriters Laboratory approved for direct underground burial when used in National Electrical Code, Class II circuit (30 volts AC or less) and sized not less than specified by manufacturer. Adjust for larger wire size according to field conditions and length of wire run to controller. Color code wire red for lead wire and white for common wire.

2.04 WIRE SPLICES:

A. "Dri-Splice" as manufactured by Spears Manufacturing Company or "DBY Connectors" as manufactured by 3-M Company.

2.05 SOLVENT, CLEANER AND PRIMER:

A. Conform to ASTM D2564
B. PVC Pipe and Fittings: Weld-On #705 Solvent and #P-70 Primer.
C. Flexible PVC Pipe to Schedule 40 Fittings: Weld-On #795 Solvent and #P-70 Primer.

2.06 QUICK COUPLER VALVES:

A. Shall be 1" bronze bodied valves with a purple rubber seat and plated cover. Keys shall be bronze constructed with 1" FIP x 1" MIP threaded.

2.07 ISOLATION VALVES:

A. Shall be 1" bronze bodied valves with a rubber seat and plated cover. Keys shall be bronze constructed with 1" FIP x 1" MIP threaded.

2.08 SWING JOINTS:

A. All rotor heads shall have a one (1") inch unitized "full circle" type, Lasco #G111-212 swing joint. Use teflon tape on all threaded joints and draw joints up snugly, do not over-tighten.
B. All spray heads shall installed on flexible pipe.

2.09 IRRIGATION HEADS:

A. Grass Spray Heads: ABS body with a 4" spring loaded pop-up nozzle assembly and 1/2" FIP connection in base; match product of any existing irrigation unless otherwise directed by Owner.
B. High-Pop Spray Head: ABS body with a 12" spring loaded pop-up nozzle assembly and 1/2" FIP connection in base; match product of any existing irrigation unless otherwise directed by Owner.
C. Nozzles: Matched precipitation rates plastic nozzle.

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D. Rotary Spray Heads: ABS body with a 4” spring loaded pop-up nozzle assembly, gear driven with 12 interchangeable nozzles and 3/4” FIP connection in base; match product of any existing irrigation unless otherwise directed by Owner.

2.10 DRIP:

A. The dripperline shall be CV series as manufactured by Netafim Irrigation, Inc. Dripper flow rate and spacing shall be as indicated on drawings, details, and notes.

2.11 REMOTE CONTROL VALVES:

A. Normally closed, globe-type diaphragm, glass-filled nylon body and cover, and Buna N reinforced diaphragm with 24-volt, 1/4 amp solenoid in a waterproofed housing. Match product of any existing irrigation unless otherwise directed by Owner.

2.12 REINFORCEMENT STAKES:

A. 1” galvanized pipe long enough to penetrate at least 36” into undisturbed soil. Use two stainless steel worm gear clamps with stainless steel screws to fasten the stake to the quick coupler.

2.13 VAVLE BOXES:

A. Use 10" round box for all field splices, Oldcastle Enclosure Solutions Model 910 with green cover, or approved equal. Extension sleeves shall be 6" PVC minimum size.

B. Use 14" X 19" standard rectangular box for all gate valves and quick coupler valves, Oldcastle Enclosure Solutions Model 1419 with green, “Drop-N-Lock” lid cover, or approved equal. Extension sleeves shall be 6" PVC minimum size.

C. Use 13" X 24" jumbo rectangular box for all electric control valves, Oldcastle Enclosure Solutions Model 1324 with green, “Drop-N-Lock” lid cover, or approved equal. Extension sleeves shall be 6" PVC minimum size.

2.14 VALVE BOX INSTALLATION AND BACKFILL:

A. Use manufacturer valve box extensions as necessary to install top of valve box flush with finish grade.

B. Securely line interior walls and bottom of valve box with filter fabric

C. Install clean, washed gravel graded from 1/2” to 1” diameter in bottom of valve box. Do not bury control valve or isolation valve.

2.15 AUTOMATIC CONTROLLER:

A. If an existing controller is available: connect any new irrigation valves to the existing controllers if possible. Contractor to insure adequate stations are available any all new irrigation. Repair all trench damage to established landscape caused by routing control wiring to controller.

B. If a new controller is required: Match product and mounting detail of any new irrigation controller with any existing controllers, unless otherwise directed by Owner.

C. Controller shall be equipped with a minimum three (3) independent programs, each with separate day cycles and a minimum of four (4) start times.

D. Controller shall be equipped with independent day scheduling options, as well as have water conservation options such as odd/even, budget, and day intervals features.

E. Controller shall be equipped with a non-volatile memory.

F. Controller shall be sized large enough to provide one station for each valve installed.

G. Install per manufacturer’s specifications. If exterior installation, insure product is rated for outdoor elements. Provide electrical power as needed as part of the work.

PART 3 - EXECUTION

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3.01 DESIGN

A. As required by State and local code, an irrigation design shall be professionally prepared and submitted for approval as a shop drawing prior to commencement of construction. The irrigation system design shall be customized specifically to the proposed planting of the project.

B. The designer shall be properly licensed, and in good and current standing with the State in order to present the design and sell the construction services. The design shall be officially sealed by a proper professional as allowed by State law.

C. The designer shall specify on the drawings all irrigation system components necessary to comply with State law and local code.

D. It is the intent to provide 1.0” of precipitation for the landscape on this project, during a 7 day watering cycle. Individual zone precipitation rates shall be designed accordingly to provide at least the 1.0” of precipitation per 7 day period.

E. It is the intent to provide zone separation for this project based on athletic field Turf, shrubs, and flowerbeds, trees and non-athletic field turf. Irrigation Industry standards for head spacing will determine the type of head required in smaller turf areas. In addition, all trees shall be equipped with (1) spray head per tree zoned separately from the shrub and flower bed zones.

F. All Irrigation sleeving shall be base bid. Irrigation system sleeving will be designed based on using two pvc pipe diameters greater than the pipe(s) being sleeved. Two inch (2”) diameter pvc pipe will be used as a minimum size for irrigation wire sleeving. It is the responsibility of the contractor to label on the irrigation design all necessary sleeving for this project. The installation of irrigation sleeving will be the responsibility of the irrigation contractor. Sleeve locations shall be permanently marked on all curbs.

G. Details will be required with irrigation design for all pertinent construction. Activity, such as valves, controllers, and sprinkler heads.

3.02 INSPECTION

Prior to commencing work, inspect site to verify that the system may be installed as required. The location of underground utilities shall be clearly and distinctly marked prior to start of trenching. Verify property measurements, critical dimensions and finish grades.

3.03 POINT OF CONNECTION (WATER SOURCE)

A. The irrigation system shall be connected to water supply points of connection as indicated on the approved shop drawings.

B. The point of connection shall be of an adequate size and as shown on the approved shop drawings.

C. The Contractor shall be responsible and furnish the point of connection, unless otherwise specified.

3.04 BACKFLOW PREVENTION

Install backflow prevention device in boxes, vaults, or enclosures as required by city code. For subsurface backflow prevention device installation, set boxes and vaults level, plumb and flush with finish grade with a minimum of 18” between any other utility or irrigation component. Center the valve or vault box over the backflow prevention device. Install one backflow prevention device per box or vault.

3.05 ELECTRICAL SUPPLY

A. Electrical connections for the automatic controller shall be made to electrical points of connection as indicated on the approved shop drawings.

B. Connections shall be made at approximate locations, as shown on the approved shop drawings. The Contractor is responsible for minor changes caused by actual site

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conditions.

C. The Contractor shall be responsible and furnish the electrical connection, unless otherwise specified.

3.06 TRENCHING

Coordinate trenching with other contractors on site. Trenches shall be a minimum of 4 inches wide. All pressurized main line piping shall have a minimum cover of 18" and lateral piping shall have a cover of 12". Minimum cover is measured from top of pipe to finish grade. All excavation shall be unclassified and shall include earth, loose rock, rock or any combination thereof, in wet or dry state.

3.07 BACKFILL

After installing pipe, trenches shall be properly backfill. Backfill shall be rock free and care shall be taken that no rocks or other obstructions rest against the pipe. Water settle backfill in lifts and compact to prevent settling. Contractor shall be responsible for placing additional topsoil, seed or sod to correct depressions after job is completed.

3.08 SLEEVING

Place sleeve pipe for irrigation lines and control wire under hardscape in separate PVC sleeves. Minimum sleeve size shall be 2". Sleeving shall have a minimum of 18" of cover from top of sleeve to bottom of slab and extend into the landscape area a minimum of 6" beyond any hardscape edge.

3.09 PIPE SIZING

Pipe shall be sufficiently sized to not exceed manufacturer's recommendations in volume and velocity.
Maximum velocity shall be 5 feet per second (fps).
Maximum volume per pipe size shall be:

Pipe Size	Max. GPM*
½"	5
¾"	11
1"	16
1 ¼"	26
1 ½"	35
2"	55
2 ½"	80
3"	120
4"	200

* GPM: Gallons per Minute

3.10 PIPE INSTALLATION

Install PVC pipe per manufacturer's specifications. Clean solvent welded joints with primer prior to using solvent. Remove excess primer from each joint.

3.11 HYDROSTATIC TEST

A. Pressure Test: After pipe is laid, joints completed and trench partially backfilled leaving joints exposed for inspection, subject the main line piping for two (2) hour hydrostatic pressure test of 100 psi, or normal city pressure if greater. Open and close each valve during the test.

B. Defective Material: Examine carefully each pipe joint, fittings and valves during the test. Joints showing visible leakage shall be replaced or remade as necessary. Removed cracked or defective pipe, joints, fittings or valves and replace with new material and repeat test until results are satisfactory. Replacement and repair shall be made at no

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additional expense to Owner.

3.12 REMOTE CONTROL VALVES

Install remote control valves where shown on the approved shop drawings. When valves are grouped together, allow at least twelve (12) inches between valves. Install each remote control valve in a separate valve box. Each valve number (per the drawings) shall be stenciled on the valve box lid with exterior paint. Paint color shall be flat black. Stencil number size shall be 3" in height.

3.13 BALL VALVES, ISOLATION VALVES

Install ball valves where shown on the approved shop drawings. Ball valves, when installed next to another utility or irrigation component, shall have at least twelve (12) inches clearance. Ball valves shall be located and installed at all mainline direction changes (tees and elbows), mainline trunk legs, and on the meter-side of the alignment prior to going under vehicular pavement. For a looped mainline, install at least one (1) ball valve at the mid-point of the mainline. Install each ball valve in a separate valve box. Each ball valve shall have stenciled on the valve box lid, "BV" with exterior paint. Paint color shall be flat black. Stencil letter size shall be 3" in height.

3.14 QUICK COUPLER VALVES

Install where shown on the approved shop drawings. Quick coupler valves shall be installed within 100’ of any proposed tree. Install each quick coupler valve in a separate valve box. Each quick coupler valve shall have stenciled on the valve box lid, "QC" with exterior paint. Paint color shall be flat black. Stencil letter size shall be 3" in height.

3.15 WIRE INSTALLATION

Install in taped bundles and place next to piping. Follow main line piping wherever possible. Install an expansion coil, 1” dia. x 6” long at all directional changes, at each valve connection, and every 100 ft. Properly insulate and waterproof all wire splices. Control wire less than 2000 ft. shall be continuous without splices or joints from the controller to the valves. Make wire splices in valve boxes, do not bury directly in soil. Run extra wires from the controller to the farthest valve. The common wire shall be one color (white), the valve wires shall be of another color (red), and the extra wire shall be of another color (blue).

3.16 AUTOMATIC CONTROLLER

Install the automatic controller(s) in accordance with the manufacturer's instructions. Remote control valves shall be connected to the controller in the numerical sequence as shown on the approved shop drawing.

3.17 SPRAY HEAD INSTALLATION

A. Grass spray heads: In turf areas, install with tops flush with finish grade. Set a minimum of 3” from sidewalks or curbs. Installation shall also be with flexible pipe to the lateral pipe.

B. High-Pop spray heads: In non-turf areas and adjacent to sidewalks or curbs, install with tops flush with finish grade. Installation shall also be with flexible pipe to the lateral pipe.

C. Nozzles: Adjust direction of throw at each head or change nozzle as required to ensure 100% coverage and minimize over-spray onto hardscape.

D. Rotary Spray Head: Install with head flush with finish grade and attach to lateral piping with swing joint assembly as specified. Installation shall also be with flexible pipe or swing joint connection to the lateral pipe.

3.18 OPERATIONAL TEST

Upon completion of installation, activate system and adjust for proper operation and efficient distribution of water. Instruct the Owner or his designated representative in the operation and maintenance of system.

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3.19 RECORD DRAWING

A. Provide “Record Drawing” on diskette in AutoCad showing triangulated dimensioned locations of valves, main line piping and wire routes with any modifications of original design.

B. Locate all dimensions from two permanent points (building, monuments, sidewalks, curbs or paving).

C. Record all changes which were made from the contract drawings including changes in pressure and non-pressure lines.

D. Record all information on a set of blueline prints of system. Do not use these prints for any other purposes.

E. Maintain information daily. Keep drawings at site and available for review by Owner or his representative.

F. After record drawings have been approved, transfer information to C.D. in AutoCad format. Make dimensions accurately at the same scale used on the drawings.

3.20 CONTROLLER CHARTS

A. Do not prepare charts until Record Drawings have been approved.

B. Provide a controller chart. Chart may be a reproduction of Record Drawing. If photo reduction prints are used, keep reduction to maximum size possible to retain legibility. Chart shall show the actual area covered by controller.

C. Identify the area covered by each valve using a distinctly different pastel color, drawn over the entire area of coverage.

D. Hermetically seal approved charts between 2 layers of 20 mil thick clear plastic sheeting.

3.21 OPERATION AND MAINTENANCE MANUALS

A. Provide two individually bound manuals detailing operating and maintenance requirements for the system.

B. Deliver manuals to Owner no later than 10 days prior to completion of work.

C. Provide descriptions of installed materials and systems in sufficient details to permit maintenance personnel to understand, operate and maintain the equipment.

D. Provide the following in each manual:

1. Index sheet, stating Irrigation Contractor’s name, address, telephone number and name of person to contact.
2. Duration of warranty period.
3. Equipment list providing manufacturer’s name, make and model, name and address of local manufacturer’s representative, spare parts list, detailed operating and maintenance instructions of major components.

3.22 CLEANUP

Clean-up shall be made daily as each portion of the work progresses. Refuse and excess dirt shall be removed, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to the original condition

3.23 TEMPORARY REPAIRS

The Owner reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the Owner shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

3.24 OPERATION

A. The entire sprinkler irrigation system shall be under full automatic operation for a period of seven (7) calendar days prior to any planting.

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B. The Owner reserves the right to waive or shorten the operation period.

3.25 FINAL OBSERVATION PRIOR TO ACCEPTANCE

A. The Contractor shall operate each system in its entirety for the Owner, at the time of the final observation. Any items deemed not acceptable by the Owner shall be re-worked to the complete satisfaction of the Owner.

B. The Contractor shall furnish the Owner with all accessories, charts, record drawings, and equipment as required prior to final inspection.

3.26 OBSERVATION SCHEDULE

A. When observations have been conducted by someone other than the Owner, show evidence, in writing, of when and by whom these observations were made.

B. NO site observations will commence without as-built drawings. In the event the Contractor calls for a site visit without as-built drawings, without completing previously noted corrections, or without preparing the system for the said visit, he shall be responsible for reimbursing the Owner at his current billing rates per hour, portal to portal (plus transportation costs) for the inconvenience. NO further site visits will be scheduled until this charge has been paid and received.

END OF SECTION

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SECTION 329213
HYDROMULCHING

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

The requirements of the "General Conditions of the Contract" shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1.02 SCOPE OF WORK

A. Furnish all labor, material, equipment, and services necessary to provide all landscape hydro-seeding work, complete in place, as shown on the drawings and as specified.

B. Work specified in this Section: The work includes, but is not necessarily limited to:

1. Soil preparation
2. Fine grading
3. Seeding via Hydrosprayer (A slurry of seed, fertilizer, water, tackifiers, biologically active soil conditioners, a color dye, and organic mulch fibers)
4. Clean-up
5. Maintenance

C. Related work in other Sections:
1. 328400 PLANTING IRRIGATION_PERFORMANCE
2. 329223 SOD

D. Definition: The term of "Landscape Architect" shall refer to Teague Nall and Perkins, Inc., 5237 N. Riverside Drive, Suite 100, Fort Worth, Texas 76137.

E. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM): D 1557 Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18 in. (457mm) Drop.

1.03 SUBMITTALS

A. Samples and Product Information: Representative samples or product information of the following materials shall be provided to the Landscape Architect from the supply source that is to be used for turf seeded areas and native wildflower or native grass seeded areas:

1. Topsoil
2. Soil Amendments
3. Fertilizer: specifications and guaranteed analysis.
4. Biological Amendments: ingredients, chemical analysis, and manufacturer.
5. Seed type and purity analysis. Save labels for field inspection by LA.
6. Tackifier material components and manufacturer.
7. Hydromulch manufacture and type of mulch to be used.
8. Biotic Soil Media

B. Construction Schedule: At least two weeks prior to start of work, submit seeding schedule.

C. Maintenance: Submit three copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of the lawns for an entire year. Submit prior to Notice of Substantial Completion. See Section 3.10, 90 DAY MAINTENANCE

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D. Chemicals: Submit products, rates of application, and anticipated uses of any pesticides, herbicides, and fumigants.

1.04 QUALITY ASSURANCE

A. Contractor's Qualifications
   1. The work of this section shall be performed by a Contractor specializing in hydro-seeding.
   2. The Contractor shall have successfully completed at least 5 installations of this type, size, and complexity in the last four years.

B. Materials shall comply with all government regulations prevailing at the supply source and the job site.

C. Fertilizers; Mixed Commercial. Federal Specification: 0-F-241D

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handling and Storage of Seed: Seed shall be kept dark, cool (between 40-50 degrees F), and dry until time of planting.

1.06 JOB CONDITIONS

A. Do not install seed on saturated, excessively dry, or frozen soil.

B. Seed installation shall be subject to suitability of the weather and other conditions affecting seed germination.

C. Planting season may be extended only with the written permission of the Landscape Architect.

1.07 SAMPLES AND TESTS

A. The Landscape Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time. The Contractor shall furnish samples upon request by the Landscape Architect. Rejected materials shall be immediately removed from the site at the Contractor's expense. Cost of the testing of materials not meeting specifications shall be paid by the Contractor.

B. After rough grading is complete, Contractor shall order and pay for a soil test which includes recommendations. Take a minimum of one soil test per 10 acres - or more as site conditions mandate. Take approximately 15 cores from each uniform soil area. Mix them thoroughly in a clean plastic or paper container. Fill the soil sample bag one-third to one-half full from this representative sample. Acceptable labs are:
   1. TPS Lab: “SO-05, TPSL® Plant Natural™ Soil Test + LOI Organic Matter + Solvita®”
   2. A&L Plains Agricultural Laboratories: “Basic Test S2” and “Basic Test S3” and “Organic Matter – by Combustion” (all three tests are required)
   3. Submit results to Landscape Architect for adjustment to soil amendments and fertilizers.

C. Contractor shall test all non-potable irrigation water before applying it to any seed or plants. All irrigation water shall meet these standards:
   4. Sodium Absorption Ratio (SAR) shall be less than 3.0
   5. Electrical Conductivity (ECe) shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade.
   6. Boron shall be less than 2 parts per million
   7. Arsenic and Lead shall each be less than 0.1 parts per million
   8. pH shall be between 6.0 and 7.5

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9. Submit lab test results to Landscape Architect for review and possible adjustments to water.

1.08 MAINTENANCE

A. All stored plant material shall be maintained in a healthy, vigorous condition by the Contractor. Maintenance includes, but is not necessarily limited to, mowing, weeding, edging, watering, trash removal, street and gutter cleaning, erosion repair, removal of siltation in drainage areas, and insect and disease chemical applications. The storage area shall be mowed, weeded, and trimmed weekly during the course of construction and the life of the storage area.

B. Within the limits of construction, the site shall be maintained in a neat, well-kept appearance by the Contractor. Maintenance includes, but is not necessarily limited to, mowing, weeding, edging, watering, trash removal, street and gutter cleaning, erosion repair, removal of siltation in drainage areas, and insect and disease chemical applications.

C. Contractor shall maintain plant material as described in Part 3.10, 90-DAY MAINTENANCE

1.09 GUARANTEE AND REPLACEMENT

A. Warrant all hydromulched areas for a period of one year from date of Notice of Substantial Completion, to be at least the quality and conditions as at Final Acceptance. Promptly reseed bare or unacceptable areas during the warranty period as directed by the Landscape Architect.

B. Lawns shall be uniform in color, grass type, leaf texture, leaf and root density, and free from weeds, diseases, and other visible imperfections at acceptance.

C. Damage to the irrigation system by other trades or persons (such as shutting off of water or power to the irrigation system) shall not affect the warranty. This means that, especially in the warm season, the Contractor shall make daily visits to the site to inspect and repair the irrigation system up until final acceptance.

1.10 FINAL INSPECTION AND ACCEPTANCE

A. The Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.

B. Acceptance will be based on establishment of a uniform stand of turf grass, defined as coverage of specified grass at a density of 95 percent coverage, with no bare spots greater than one square foot, free of weeds, undesirable grass species, disease, and insects. For grass varieties selected, allow a minimum of 90 days for establishment and maintenance of an acceptable strand of grass.

C. In areas that are grassed and not irrigated. An acceptable strand of grass shall be established and the Landscape Architect will inspect the work for Substantial Completion upon written request of the Contractor.

D. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Landscape Architect, the Landscape Architect will recommend to the Owner that the work of this Section be accepted.

PART 2 - MATERIALS

2.01 HYDROMULCHING

A. All seed shall be fresh, clean, dry new crop seed tested for minimum percentages of purity and germination and label in accordance with the U.S. Department of Agriculture regulations. Seed tags shall not be more than 9 months old.

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1. Pure Live Seed (PLS) shall not be less than 90 percent.
2. Maximum weed content shall be 0.30 percent.

B. Seed Mix: See drawings for actual seed mix(es) used on project.
   1. Bermuda seed type shall be hulled certified 'Sahara II' Bermuda by Pennington Seed. Seed shall contain certified seed composed of the following PLS (by weight):
      a. Material: Permanent seed variety.
      b. Seed: Must be Certified Sahara II.
      c. Inert Material: Less than 1%.
      d. Other Crop Seed: Less than .5%.
      e. Weed Seed: Less than 1%.
      f. Coating: MYCO Advantage coated.
      g. Packaging: 25lb Plastic container.
   2. Southeast Recovery Mix shall be a specified mixture of grass and wildflower seeds from Native American Seed (800) 728-4043.
   3. TxDOT Fort Worth Mix shall contain certified seed composed of the following PLS (by weight):

a.	1. Green Sprangletop (Van Horn)	1.0 lbs./ per acre
b.	2. Sideoats Grama (Haskell)	1.0 lbs./ per acre
c.	3. Texas Grama (Atascosa)	1.0 lbs./ per acre
d.	4. Hairy Grama (Chaparral)	0.4 lbs./ per acre
e.	5. Shortspike Windmillgrass (Welder)	0.2 lbs./ per acre
f.	6. Little Bluestem (OK Select)	0.8 lbs./ per acre
g.	7. Purple Prairie Clover (Cuero)	0.6 lbs./ per acre
h.	8. Engelmann Daisy (Eldorado)	0.8 lbs./ per acre
i.	9. Illinois Bundleflower	1.3 lbs./ per acre
j.	10. Awnless Bushsunflower (Plateau)	0.2 lbs./ per acre

C. Root Inoculant: SaberEx for Wheat and Cereals by ABM (or approved equal). Apply as a dry seed treatment prior to seeding:
   1. Active Ingredient: 1.0% Trichoderma harzianum 2.5x10 7 cfu/gm
   2. Inert Ingredients: Graphite 60.0%, Cellulose 24.0%, Talc 15.0%

D. Tackifier: By Profile Products or approved equal. Tackifier shall be included in Hydromulch and factory mixed. Follow manufacturer's recommendations.

E. pH Soil Doctor: (granular humate soil amendment) from Browning Seed, Inc. (800) 243-5271, http://www.browningseed.com or approved equal, with formulation of:
   1. Humic Acid 37.50%
   2. Calcium (CaSo4) 10.00%
   3. Sulfur (S) 7.00% (to lower pH)
   4. Calcium Sulfate(CaSo4) 34.00% (Derived from quarried calcium sulfate)
   5. Water Soluble Binder-lignosulfonate .50%

F. Fertilizer for Hydromulch areas: Italpollina 4-4-4 or approved equal. Product shall be an OMRI registered organic fertilizer of a guaranteed analysis, 4-4-4, containing no less than 41% total organic Carbon, 71% organic matter, and 5% humic acid. Contact: Allen Olson (817) 368-8615, allen@gdrsystems.net

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G. Hydromulch: Shall be manufactured by Profile Products LLC or approved equal. Hydromulch shall be a fully biodegradable, Hydraulic Mulch composed of 100% recycled Thermally Refined wood fibers, cellulose fibers, and wetting agents (including high-viscosity colloidal polysaccharides). Hydromulch shall be phytosanitized, free from plastic netting, and upon application form an intimate bond with the soil surface to create a porous, absorbent and flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth.

1. Seeded areas less than 5:1 slope: Soil Cover Blend with Tack, by Profile Products:
   a. Thermally Refined® Wood Fibers (minimum) – 58%
   b. Cellulose Fiber (maximum) – 27%
   c. Polymer Tackifier – 3% ± 0.5%
   d. Moisture Content – 12% ± 3%
2. Seeded areas with slopes 5:1 or greater: Flexterra HP-FGM, by Profile Products:
   a. All components of the HP-FGM shall be pre-packaged by the Manufacturer to assure both material performance and compliance with the following values. Under no circumstances shall field mixing of components be permitted. No chemical additives except for fertilizer, soil neutralizers and biostimulant materials should be added to this product.
   b. Thermally Processed* (within a pressurized vessel) Virgin Wood Fibers – 80%
   c. *Heated to a temperature greater than 380 degrees Fahrenheit (193 degrees Celsius) for 5 minutes at a pressure greater than 50 psi (345 kPa)
   d. Wetting agents (including high-viscosity colloidal polysaccharides, cross-linked biopolymers, and water absorbents) – 10%
   e. Crimped Biodegradable Interlocking Fibers – 5%
   f. Micro-Pore Granules – 5%

H. Water: Source furnished by the Contractor, cost and transport of water, as required, by the Contractor. Water to be as described in 1.07.C.

2.02 TOPSOIL

A. All existing topsoil stripped for this work and suitable for reuse shall be stored on site as directed by the Landscape Architect. Dispose of all excess topsoil on the site as directed by the Landscape Architect.

B. Utilize on-site and imported topsoil to provide a minimum six inch (6”) layer of approved soil for hydromulch installation as specified and indicated on the Drawings.

C. ProGanics Biotic Soil Media, by Profile Products to be used on all hydromulch and seeded areas.

D. If on-site topsoil is not available, imported topsoil shall be used as indicated on the drawings and as follows:

1. Imported Top Soil shall be natural, loose, fertile, friable, screened agricultural soil, having characteristics of representative productive soils in the vicinity, and obtained from naturally well-drained areas. Imported Soil for seeded areas to be: “Enriched Top Soil”, by Soil Building Systems, (972) 831-8181, or approved equal, submit a 1-quart package with supplier label attached to sample
2. Silt plus clay content of the import soil shall not exceed 20% by weight with a minimum 95% passing the 2.0 millimeter sieve. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade. The boron content shall be no greater than 1 part per million as measured on the saturation extract. In order to insure

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conformance, samples of the import soil shall be submitted to the laboratory for analysis prior to, and following, backfilling.

3. Imported Topsoil shall be free of insects, harmful nematodes, soil-borne diseases, toxins, heavy clay, select fill, inorganic subsoils, heavy metals, trash, petroleum by-products, rocks over 1” diameter, rubble, roots, weeds, or weed seeds.
4. Imported Topsoil shall have a pH between 6.5 - 7.3.

PART 3 - EXECUTION

3.01 INSPECTION

A. Obtain written certification from the General Contractor that final grades to within 0.10' have been established prior to commencing planting operations. Provide for inclusion of all amendments, settling, etc. The Contractor shall be responsible for shaping all planting areas as indicated on the drawings, or as directed by the Landscape Architect.

B. Inspect site to ensure that it is ready to be seeded and that irrigation system is working for all areas to receive seed.

3.02 EXCAVATION

A. In all hydromulched and seeded areas, the Contractor shall *thoroughly* remove from the construction site all limestone larger than 1/2" in diameter and all heavy clay to a minimum depth of 6”. The LA shall verify that this is complete before the Contractor is authorized to proceed with fill of specified topsoil or grading. Scarify subsoil after removal of rock or heavy clay before adding topsoil so as to break up any surface tension.

B. The Contractor shall thoroughly remove from the construction site all the following particles that are larger than 1/2" in diameter: inorganic select fill, heavy clay, limestone, and construction debris, mortar, concrete, paint, paint thinner, chemicals, weeds, plastic, paper, steel, wire, mortar, masonry, construction debris, and other substances that are harmful to plant growth. Remove the above items to these depths: 6” minimum in turf and seed areas, and 18" minimum in planting beds. The LA shall verify that the above items are removed before the Contractor is authorized to proceed with fill with specified topsoil or grading. DO NOT PLACE ANY FILL ON CONSTRUCTION DEBRIS.

C. After clean-up described above and establishment of subgrade, drag entire planting area with teeth of bucket to scarify subsoil to a depth of 4” to break up surface tension and allow water to pass downwards through the soil.

D. If soils are rocky or full of limestone or heavy clay, install irrigation system before adding topsoil to keep limestone or clay below imported topsoil and the root zone of plants.

E. Excavation for planting shall include the stripping and stockpiling of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits, and planting beds.

F. Excess soil generated from the planting holes and not used as backfill or in the establishment of the final grades, shall be removed to an on-site location, as approved by the Owner. Unacceptable excess soil shall be removed to an appropriate off-site location.

G. Protect all areas from excessive compaction when trucking plants or other material to the planting site. Existing vegetation identified by the Landscape Architect to remain, shall be protected from trucking operations during the course of construction.

3.03 PRE-PLANT WEED CONTROL

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A. After the irrigation system is operational and approved by the Landscape Architect, apply water for seven (7) to ten (10) calendar days, as needed to achieve weed germination.

B. If live perennial weeds exist on site at the beginning of the work, spray with a non-selective, systemic contact herbicide, as recommended and applied by an approved, licensed landscape pest control applicator. Leave sprayed plants intact for at least fourteen (14) days to allow systemic kill. Reapply at 2-week intervals until a complete kill is achieved.

C. Clear and remove these existing, dead weeds by mowing or grubbing off all plant parts at least 1" below the surface of the soil over the entire area to be planted.

D. Maintain the site weed-free until final acceptance by the Landscape Architect, utilizing mechanical and chemical treatment.

3.04 SOIL PREPARATION

A. Grade Preparation

1. Immediately before hydromulching, power-rake, scarify, loosen, float and drag the upper 6” of topsoil to bring it to the proper condition. Remove foreign matter larger than 1/2” in diameter. Hydromulch areas shall have topsoil that is light and fluffy after preparation.
2. If there is not sufficient existing approved topsoil on site, apply imported topsoil as specified in Section 2, MATERIALS, to achieve finish grade. If required, import specified and approved topsoil to achieve depth of (6”) depth in all seeded areas.
3. Amendments: Apply pH Soil Doctor granular Humate at a rate of 500 lbs. per acre directly into slurry.
4. Fine Grading: After tillage and cleaning, all areas to be planted shall be leveled, fine graded, and drug with a weighted spike harrow or float drag. The required result shall be the elimination of ruts or depressions that would cause water to stand or pond immediately after rainfall or operation of the lawn irrigation system, humps, and objectionable soil clods. This shall be the final soil preparation step to be completed before the commencement of fertilizing and planting.
5. If the prepared grade is eroded or compacted by rainfall prior to fertilizing, rework the surface to specified condition.
6. Hydromulch tp be placed after final grade is approved in a timely manner not to exceed a 48-hour period from time of approval to hydromulching.

B. Spreading of Topsoil:

1. Topsoil and subgrade shall be damp when topsoil is spread. Top of subsoil shall be scarified and loose, not a hardpan before adding topsoil.
2. Areas to be seeded shall be top-soiled to a minimum depth of six inches (6”), compacted measure. Provide additional topsoil depths as required to construct the grades indicated on the Drawings. Topsoil shall be compacted to 85%, determined in accordance with ASTM: D 1557. Onsite topsoil is to be used unless it is not available, or is more than 25% clay, or is more than 10% limestone, or is rocky.

3.05 HYDROMULCHING

A. Hydromulch to be placed after final grade is approved in a timely manner not to exceed a 48-hour period from time of approval to hydromulching. Do not allow soil to dry out and crust over.

B. Apply seed via Hydromulch only (not via drill box or hand-spreading) during the periods indicated below unless otherwise approved by the Landscape Architect. Do not sow seed when weather conditions are unfavorable, such as during drought, rain, extreme cold or heat, or high winds. All seed shall be pre-treated at seed supplier with Root Inoculant (See Section 2.1C). Ship and plant seed immediately.

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C. Hydromulching is much preferred over drill box or spreader. However, under certain circumstances, and if approved in writing by Landscape Architect, and if site is large enough and allows room for a tractor, the Landscape Architect may approve seeding using equipment such as cultipacker seeders (preferred), grass seed drill, or wildflower seeder. Seeds shall be evenly installed in multiple passes to a depth of ¼"- ½" under the surface of the soil at the rate specified on the plans.

D. Warm season turf grasses: Apply between April 15 and September 1, or when the ground temperature is above 65 degrees Fahrenheit.

E. Cool season turf grasses: Apply between September 1 and March 15, when temperatures are above 40 degrees Fahrenheit.

F. Native Grass Seed Mixes:

1. Without irrigation: Sow between March 1 and May 30.
2. With irrigation: Sow from March 1 to Sep 15 –(do not irrigate until after Apr. 1)

G. Native Wildflower Seed Mixes: Sow between September 15 and Nov 15.

H. If seeding cannot occur within the specified period; an alternative will be proposed by the Contractor for approval by Landscape Architect.

I. For seeded turfgrasses areas only - apply fertilizer (see section 2.1 F) with specified prescriptive agronomic formulations recommended in soil test. Hydromulch turf seed at a rate of 300 lbs. per acre over properly prepared surfaces. Confirm loading rates with equipment manufacturer.

J. Do not apply seed onto saturated soils or substrates.

K. Do not apply seed if rain is anticipated within 48 hours.

L. Prior to seeding, ensure that all soil shall be smooth, loose, and fluffy to a depth of 6".

M. Hydromulching: All seeded areas are to be sprayed with a slurry using conventional Hydro-Mulch equipment as manufactured by the Bowie Machine Works, or an approved equal. See Section 2.1, HYDROMULCHING for manufacturers of materials. The hydromulch slurry shall be thoroughly mixed with seed and applied at the rate of:

1. Seed: Variety and rate as called out on plans.
2. Hydromulch: 46 pounds per one thousand 1,000 SF (2,000 pounds per acre)
3. Water: 23 gallons per 1,000 square feet (1,000 gallons per acre).
4. Granular humate soil amendment: (10) lbs. per 1000 SF (435 pounds per acre)
5. Fertilizer: Apply 1200 lbs. per acre or 28 lbs. per 1000 sq. ft.

N. Strictly comply with equipment manufacturer's installation instructions and recommendations. Use approved hydro-spraying machines with fan-type nozzle (50-degree tip).

1. To achieve optimum soil surface coverage, apply Hydromulch from opposing directions downward to soil surface.
2. Use pressure of sprayer to force seed downward, 1/8" deep into soil.
3. Apply evenly to achieve 75% minimum cover.
4. Rough surfaces (rocky terrain, cat tracks and ripped soils) may require higher application rates to achieve specified cover.
5. Slope interruption devices or water diversion techniques are recommended when slope lengths exceed 25 feet (8 m). Maximum slope length is for product applications on a 4H:1V slope. For application on steeper slopes, slope interruption lengths may need to be decreased based on actual site conditions.
6. Do not install in channels or areas with concentrated water flow. No chemical additives with the exception of products listed above should be added to slurry.

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O. Water thoroughly and immediately with a fine mist until soil is soaked to a depth of 3". Maintain soil in a moist condition until seeds have sprouted and reached a height of 1". Water thereafter at least once every 7 days unless natural rainfall has provided equivalent watering.

3.06 CLEAN-UP

A. After all planting operations have been completed, remove all trash, excess soil, empty plant containers, pallets, ties, rubbish, and all debris associated with this contract from the site. All scars, ruts, trench settlement, or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site. The Contractor shall pick up all trash resulting from this work no less frequently than each Friday before leaving the site, once a week, or the last working day of each week. All trash shall be removed completely from the site.

B. The Contractor shall leave the site area broom-clean and shall wash down all paved areas within the Contract area, leaving the premises in a clean condition. All walks shall be left in a clean and safe condition.

C. Excess topsoil not required for lawns or planting shall be stockpiled on site for future use as directed by the Owner's representative.

D. Repair existing lawns damaged by operations under the contract. Repair shall include finish grading, seeding as required to match existing grade and lawn, and maintenance of repaired areas.

3.07 OBSERVATION SCHEDULE

A. The Contractor shall be responsible for notifying the Landscape Architect in advance for the following site visits, according to the time indicated:

1. Pre-job Conference - 7 days
2. Final grade review - 2 days
3. Seed material review - 2 days
4. Soil Preparation and planting operations - 2 days
5. Pre-maintenance - 7 days
6. Final inspection - 7 days

B. When observations are conducted by someone other than the Landscape Architect, the Contractor shall show evidence, in writing, of when and by whom these observations were made.

C. NO site visits shall commence without all items noted in previous Observation Reports either completed or remedied unless such compliance has been waived by the Owner. Failure to accomplish punch list tasks or prepare adequately for desired inspections shall make the Contractor responsible for reimbursing the Landscape Architect at his current billing rates per hour, portal to portal (plus transportation costs) for the inconvenience. NO further inspections shall be scheduled until this charge has been paid and received.

3.08 GUARANTEE

A. All plant material shall be guaranteed by the contractor for a period of one (1) year from the date of final acceptance.

B. At the end of the guarantee period the Landscape Architect and Contractor shall inspect plant material. Any plant material under this contract that is dead or of an unsatisfactory growth condition shall be removed and replaced in a timely fashion by the contractor, at no cost to the owner.

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3.09 ACCEPTANCE OF WORK

A. The contractor and Landscape Architect shall conduct an on-site inspection of all work and materials to determine compliance of work with the construction documents.

B. The contractor shall within reasonable means provide the Landscape Architect with sufficient data to demonstrate compliance with the construction documents.

C. The contractor shall be notified in writing of any non-conforming items, which are to be corrected (punch-list).

D. The contractor and Landscape Architect shall conduct an on-site inspection to verify completeness of punch list items.

E. Acceptance of work by the Owner shall begin upon verifying completion of punch list items and receipt of all deliverable items to Owner including letter of guarantee; release of liens waiver, record drawings denoting deviations from contract drawings, product data and maintenance guide.

F. The contractor shall receive written notification of date of final acceptance and ending date of required guarantee periods from the Landscape Architect.

3.10 90 DAY MAINTENANCE

A. A. The maintenance period shall commence when the Notice of Substantial Completion is issued and shall continue as required for a period of 90 days.

B. Contractor shall be responsible for all costs associated with establishment during the maintenance period to include, but not be limited to: cost of water, electricity, fertilizer, replacement seed and other materials, equipment, transportation, and labor, etc.

C. Immediately after hydromulching, the area shall be protected against traffic or other use by erecting barricades as needed, and by placing approved warning signs at appropriate intervals.

D. Contractor shall touch-up hydromulch areas as required to achieve full coverage at no cost to Owner.

E. Mow turf grasses only (not wildflower or native grass areas) during establishment only for the purpose of weed control and to promote quicker spreading.

   a. Mow Bermuda and Zoysia Grass to a 2” height.

   b. Mow at least once a week in the growing season once turf is rooted and growing.

F. Fill any depressions, settlement, or washouts that occurs within 90 days following installation. Reseed bare spots that occur during the maintenance period as directed by the Landscape Architect at no cost to Owner.

G. Keep hydromulched areas clean and protected from damage during the maintenance period. Debris that accumulates shall be removed from the site. Promptly repair damaged lawns except as pro-vided in Section 1.9, GUARANTEE AND REPLACEMENT.

H. Irrigate as required to supplement natural rainfall so that all lawn areas receive sufficient water for normal plant growth. Furnish all irrigation equipment needed for watering and be responsible for securing adequate supply of water if an automatic irrigation system does not exist, is not operating, or is damaged.

I. Hydromulched areas are to be maintained so as to be weed-free. If live perennial or annual weeds exist within sod areas, remove them mechanically or spray them with a selective and systemic contact herbicide, as recommended and applied by an approved, licensed landscape pest control applicator. Leave sprayed plants intact for at least fourteen (14) days to allow systemic kill. Reapply at 2-week intervals until a complete kill is achieved while being careful not to damage surrounding turfgrass. Maintain the site weed-free until final acceptance by the Landscape Architect, utilizing mechanical and chemical treatment.

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J. A second fertilizer application shall be made 60 days after installation to turfgrasses. The specified fertilizer shall be a ratio of 15-5-10 applied at 800 pounds per acre.

END OF SECTION

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SECTION 329223
SOD

PART 1 - GENERAL

1.01 GENERAL CONDITIONS

The requirements of the "General Conditions of the Contract" shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1.02 SCOPE OF WORK

A. Furnish all labor, material, equipment, and services necessary to provide all landscape sodding, and sprigging work, complete in place, as shown on the drawings and as specified.

B. Work specified in this Section: The work includes, but is not necessarily limited to:

1. Soil preparation
2. Fine grading
3. Sodding (Solid rolled Sod)
4. Clean-up
5. Maintenance

C. Related work in other Sections:
1. 328400 PLANTING IRRIGATION_PERFORMANCE
2. 329213 HYDROMULCHING

D. Definition: The term of "Landscape Architect" shall refer to Teague Nall and Perkins, Inc., 5237 N. Riverside Drive, Suite 100, Fort Worth, Texas 76137.

E. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. American Society for Testing and Materials (ASTM): D 1557 Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10 lb. (4.54 kg) Rammer and 18 in. (457mm) Drop.

1.03 SUBMITTALS

A. Samples and Product Information: Representative samples or product information of the following materials shall be provided to the Landscape Architect from the supply source that is to be used for turf areas:

1. Topsoil
2. Soil Amendments
3. Fertilizer: specifications and guaranteed analysis.
4. Biological Amendments: ingredients, chemical analysis, and manufacturer.
5. Sod certification documentation to include the following:
   a. Kind – Bermuda 419, Common Bermuda, St. Augustine, etc.
   b. Variety – Bermuda TifTuf, Tif 419, etc.
   c. Lot Number – If applicable
   d. Record of square feet of sod shipped.
   e. Bill of Lading / Invoice # - This is an invoice number that can be referenced to the purchaser of the shipment.

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f. Field # - the field number references the harvested grass to the production field. The field number must be the same as on the certification application and field inspection report.

g. Harvest Date – Record the date the grass was harvested.

h. Grower Name and Address- Record the production company name and address. Use of a stamp is acceptable if it shows on all copies.

B. Construction Schedule: At least two weeks prior to start of work, submit sodding schedule.

C. Maintenance: Submit three copies of typewritten instructions recommending procedures to be established by the Owner for the maintenance of the lawns for an entire year. Submit prior to Notice of Substantial Completion. See Section 3.10, 90 DAY MAINTENANCE

D. Chemicals: Submit products, rates of application, and anticipated uses of any pesticides, herbicides, and fumigants.

1.04 QUALITY ASSURANCE

A. Contractor's Qualifications

1. The work of this section shall be performed by a Contractor specializing in sodding or landscape installations.

2. The Contractor shall have successfully completed at least 5 installations of this type, size, and complexity in the last four years.

B. Lawn materials shall comply with all government regulations prevailing at the supply source and the job site.

C. Fertilizers; Mixed Commercial. Federal Specification: 0-F-241D

1.05 DELIVERY, STORAGE, AND HANDLING

A. Digging Sod

1. Do not dig sod at the nursery or other approved source until ready to transport sod to the project site or approved storage location.

2. Before stripping, sod shall be mowed at a uniform height of 2”.

3. Sod to be cut and delivered in rolled widths.

4. Cut sod to specified thickness and to standard width and length desired.

B. Transporting Sod

1. Sod transported to the Project in open vehicles shall be covered with tarps or other suitable covers securely fastened to the body of the vehicle to prevent injury to the sod. Closed vehicles shall be adequately ventilated to prevent overheating of the sod. Evidence of inadequate protection against drying out in transit shall be cause for rejection.

2. Sod shall be kept moist, fresh, and always protected. Such protection shall encompass the entire period during which the sod is in transit, being handled, or in temporary storage.

3. Transporting sod in excess of 20 miles from the site shall be done during evening, night, early morning hours during summer months

4. Upon arrival at the temporary storage location or the site of the work, sod shall be inspected for proper shipping procedures. Should the roots be dried out, the Landscape Architect will reject the sod. When sod has been rejected, the Contractor shall remove it at once from the area of the work and replace it at no cost to Owner.

5. Unless otherwise authorized by the Landscape Architect, the Contractor shall notify the Landscape Architect at least 48 hours in advance of the anticipated delivery date of sod. A

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legible copy of the invoice, showing species and variety of sod included for each shipment shall be submitted to the Landscape Architect.

6. Certificate of Inspection when required must accompany each sod shipment.

C. Handling and Storage of Sod

1. No sod shall remain in temporary storage over 30 hours, and less time may be required during extremely high temperatures.
2. Sod shall be kept moist and shall be stored in a compact group to prevent drying out or freezing.
3. Contractor shall take extreme care in the handling of sod material to avoid breaking or tearing strips. Sod that has been damaged by poor handling may be rejected by the Landscape Architect.

1.06 JOB CONDITIONS

A. Do not install sod on saturated, excessively dry, or frozen soil.

B. Sod installation shall be subject to suitability of the weather and other conditions affecting sod growth.

C. Planting season may be extended only with the written permission of the Landscape Architect.

1.07 SAMPLES AND TESTS

A. The Landscape Architect reserves the right to take and analyze samples of materials for conformity to specifications at any time. The Contractor shall furnish samples upon request by the Landscape Architect. Rejected materials shall be immediately removed from the site at the Contractor's expense. Cost of the testing of materials not meeting specifications shall be paid by the Contractor.

B. After rough grading is complete, Contractor shall order and pay for a soil test which includes recommendations. Take a minimum of one soil test per 10 acres - or more as site conditions mandate. Take approximately 15 cores from each uniform soil area. Mix them thoroughly in a clean plastic or paper container. Fill the soil sample bag one-third to one-half full from this representative sample. Acceptable labs are:

1. TPS Lab: “SO-05, TPSL® Plant Natural™ Soil Test + LOI Organic Matter + Solvita®”
2. A&L Plains Agricultural Laboratories: “Basic Test S2” and “Basic Test S3” and “Organic Matter – by Combustion” (all three tests are required)
3. Submit results to Landscape Architect for adjustment to soil amendments and fertilizers.

C. Contractor shall test all non-potable irrigation water before applying it to any sod. All irrigation water shall meet these standards:

1. Sodium Absorption Ratio (SAR) shall be less than 3.0
2. Electrical Conductivity (ECe) shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade.
3. Boron shall be less than 2 parts per million
4. Arsenic and Lead shall each be less than 0.1 parts per million
5. pH shall be between 6.0 and 7.5
6. Submit lab test results to Landscape Architect for review and possible adjustments to water.

1.08 MAINTENANCE

A. All stored plant material shall be maintained in a healthy, vigorous condition by the Contractor. Maintenance includes, but is not necessarily limited to, mowing, weeding, edging, watering, trash removal, street and gutter cleaning, erosion repair, removal of siltation in drainage areas,

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and insect and disease chemical applications. The storage area shall be mowed, weeded, and trimmed weekly during the course of construction and the life of the storage area.

B. Within the limits of construction, the site shall be maintained in a neat, well-kept appearance by the Contractor. Maintenance includes, but is not necessarily limited to, mowing, weeding, edging, watering, trash removal, street and gutter cleaning, erosion repair, removal of siltation in drainage areas, and insect and disease chemical applications.

C. Contractor shall maintain plant material as described in Part 3.6, 90-DAY MAINTENANCE

1.09 GUARANTEE AND REPLACEMENT

A. Warrant all lawns for a period of one year from date of Notice of Substantial Completion, to be at least the quality and conditions as at Final Acceptance. Promptly re-sod unacceptable areas during the warranty period as directed by the Landscape Architect.

B. Lawn shall be uniform in color, grass type, leaf texture, leaf and root density, and free from weeds, diseases, and other visible imperfections at acceptance.

C. Damage to the irrigation system by other trades or persons (such as shutting off of water or power to the irrigation system) shall not affect the warranty. This means that, especially in the warm season, the Contractor shall make daily visits to the site to inspect and repair the irrigation system up until final acceptance.

1.10 FINAL INSPECTION AND ACCEPTANCE

A. The Landscape Architect will inspect all work for Substantial Completion upon written request of the Contractor. The request shall be received at least ten calendar days before the anticipated date of inspection.

B. Acceptance will be based on establishment of a uniform stand of turf grass, defined as coverage of specified grass at a density of 95 percent coverage, with no bare spots greater than one square foot, free of weeds, undesirable grass species, disease, and insects. For grass varieties selected, allow a minimum of 90 days for establishment and maintenance of an acceptable strand of grass.

C. In areas that are grassed and not irrigated. An acceptable strand of grass shall be established and the Landscape Architect will inspect the work for Substantial Completion upon written request of the Contractor.

D. Upon completion and re-inspection of all repairs or renewals necessary in the judgment of the Landscape Architect, the Landscape Architect will recommend to the Owner that the work of this Section be accepted.

PART 2 – MATERIALS

2.01 SOLID SOD

A. Sod shall be as specified on plans, nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully and otherwise maintained from planting to harvest. Sod must be mowed two (2) days prior to cutting.

B. All sod shall be “Certified Sod” from a licensed and certified sod producer. Provide test results from a plant pathology lab to LA for approval before purchase.

C. For sports fields, or if called out on plans, use only rolled solid sod.

D. Thickness of Cut: Sod shall be cut to have minimum pad thickness of:

1. Bermuda Grass: 3/4” minimum thickness, with plus/ minus 1/8” tolerance
2. St. Augustine, Buffalo, and Zoysia Grass: 1” thick, with plus/ minus 1/8” tolerance

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E. Width and Length of Sod: Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2" on width, and plus or minus 5% on length. Broken strips and torn or uneven ends will be rejected.

F. Strength of Sod Strips: Sod strips shall be strong enough to support their own weight and retain their size and shape if suspended vertically when grasped in the upper 10% of the section.

G. Moisture Content: Sod shall not be harvested or transplanted when moisture content (excessively wet or dry) may adversely affect its survival.

H. Sod shall consist of live growing plants secured from sources which have dense, thickly matted root system throughout the soil of the sod for a minimum of one inch. Sod shall be free of weeds or other varieties of grasses.

I. Reject any Sod whose roots are dried because of sun or wind. The landscape architect has the right to reject any or all of sod due to lack of care, improper cutting, or other agronomic problems.

J. Time Limitations: Sod shall be harvested, delivered, and transplanted within a 30-hour period unless a suitable preservation method is approved by the Landscape Architect prior to delivery. Sod not transplanted within this period shall be inspected and approved by the Landscape Architect prior to its installation.

K. Thatch: Sod shall be relatively free of thatch. A maximum on 1/2" (uncompressed) thatch will be permitted.

L. Sod shall be free of diseases, harmful insects, nematodes, soil borne diseases, Nutsedge, and all other grassy and broadleaf weeds.

M. Fertilizer for Sod areas: Italpollina 4-4-4 or approved equal. Product shall be an OMRI registered organic fertilizer of a guaranteed analysis, 4-4-4, containing no less than 41% total organic Carbon, 71% organic matter, and 5% humic acid. Contact: Allen Olson (817) 368-8615, allen@gdrsystems.net

N. Water: Source furnished by the Contractor, cost and transport of water, as required, by the Contractor. Water to be as described in 1.07.C.

2.02 TOPSOIL

A. All existing topsoil stripped for this work and suitable for reuse shall be stored on site as directed by the Landscape Architect. Dispose of all excess topsoil on the site as directed by the Landscape Architect.

B. Utilize on-site and imported topsoil to provide a minimum six-inch (6") layer of approved soil for sod installation as specified and indicated on the Drawings.

C. If on-site topsoil is not available, imported topsoil shall be used as indicated on the drawings and as follows:

1. Imported Top Soil shall be natural, loose, fertile, friable, screened agricultural soil, having characteristics of representative productive soils in the vicinity, and obtained from naturally well-drained areas. Imported Soil for sod areas to be: "Enriched Top Soil", by Soil Building Systems, (972) 831-8181, or approved equal, submit a 1-quart package with supplier label attached to sample.

2. Silt plus clay content of the import soil shall not exceed 20% by weight with a minimum 95% passing the 2.0-millimeter sieve. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade. The boron content shall be no greater than 1 part per million as measured on the saturation extract. In order to ensure conformance, samples of the import soil shall be submitted to the laboratory for analysis prior to, and following, backfilling.

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3. Imported Top Soil shall be free of insects, harmful nematodes, soil-borne diseases, toxins, heavy clay, select fill, inorganic subsoils, heavy metals, trash, petroleum by-products, rocks over 1” diameter, rubble, roots, Nutgrass, or weeds, or weed seeds.
4. Imported Topsoil shall have a pH between 6.5 - 7.3.

PART 3 - EXECUTION

3.01 INSPECTION

A. Obtain written certification from the General Contractor that final grades to within 0.10' have been established prior to commencing planting operations. Provide for inclusion of all amendments, settling, etc. The Contractor shall be responsible for shaping all planting areas as indicated on the drawings, or as directed by the Landscape Architect.

B. Inspect site to ensure that it is ready to be sodded and that irrigation system is working for all areas to receive sod.

3.02 EXCAVATION

A. In all sod areas, the Contractor shall *thoroughly* remove from the construction site all limestone larger than 1/2" in diameter and all heavy clay to a minimum depth of 6”. The LA shall verify that this is complete before the Contractor is authorized to proceed with fill of specified topsoil or grading. Scarify subsoil after removal of rock or heavy clay before adding topsoil so as to break up any surface tension.

B. The Contractor shall thoroughly remove from the construction site all the following particles that are larger than 1/2" in diameter: inorganic select fill, heavy clay, limestone, and construction debris, mortar, concrete, paint, paint thinner, chemicals, weeds, plastic, paper, steel, wire, mortar, masonry, construction debris, and other substances that are harmful to plant growth. Remove the above items to these depths: 6” minimum in turf and seed areas, and 18" minimum in planting beds. The LA shall verify that the above items are removed before the Contractor is authorized to proceed with fill with specified topsoil or grading. DO NOT PLACE ANY FILL ON CONSTRUCTION DEBRIS.

C. After clean-up described above and establishment of subgrade, drag entire planting area with teeth of bucket to scarify subsoil to a depth of 4” to break up surface tension and allow water to pass downwards through the soil.

D. If soils are rocky or full of limestone or heavy clay, install irrigation system before adding topsoil so as to keep limestone or clay below imported topsoil and the root zone of plants.

E. Excavation for planting shall include the stripping and stockpiling of all acceptable topsoil encountered within the areas to be excavated for trenches, tree holes, plant pits, and planting beds.

F. Excess soil generated from the planting holes and not used as backfill or in the establishment of the final grades, shall be removed to an on-site location, as approved by the Owner. Unacceptable excess soil shall be removed to an appropriate off-site location.

G. Protect all areas from excessive compaction when trucking plants or other material to the planting site. Existing vegetation identified by the Landscape Architect to remain, shall be protected from trucking operations during construction.

3.03 PRE-PLANT WEED CONTROL

A. After the irrigation system is operational and approved by the Landscape Architect, apply water for seven (7) to ten (10) calendar days, as needed to achieve weed germination.

B. If live perennial weeds exist on site at the beginning of the work, spray with a non-selective, systemic contact herbicide, as recommended and applied by an approved, licensed landscape

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pest control applicator. Leave sprayed plants intact for at least fourteen (14) days to allow systemic kill. Reapply at 2-week intervals until a complete kill is achieved.

C. Clear and remove these existing, dead weeds by mowing or grubbing off all plant parts at least 1" below the surface of the soil over the entire area to be planted.

D. Maintain the site weed-free until final acceptance by the Landscape Architect, utilizing mechanical and chemical treatment.

3.04 SOIL PREPARATION

A. Grade Preparation

1. Immediately before sodding, power-rake, scarify, loosen, float and drag the upper 6” of topsoil to bring it to the proper condition. Remove foreign matter larger than 1/2” in diameter. Sod areas shall have topsoil that is smooth and compacted to 85% after preparation.
2. If there is not sufficient existing approved topsoil on site, apply imported topsoil as specified in Section 2.1 G, MATERIALS, to achieve finish grade. If required, import topsoil to achieve depth of (6”) of approved topsoil in all turf areas.
3. Fine Grading: After tillage and cleaning, all areas to be planted shall be leveled, fine graded, and drug with a weighted spike harrow or float drag. The required result shall be the elimination of ruts or depressions that would cause water to stand or pond immediately after rainfall or operation of the lawn irrigation system, humps, and objectionable soil clods. This shall be the final soil preparation step to be completed before the commencement of fertilizing and planting.
4. If the prepared grade is eroded or compacted by rainfall prior to fertilizing, rework the surface to specified condition.
5. Sod to be placed after final grade is approved in a timely manner not to exceed a 48-hour period from time of approval to laying of sod.

B. Spreading of Topsoil:

1. Topsoil and subgrade shall be damp when topsoil is spread. Top of subsoil shall be scarified and loose, not a hardpan before adding topsoil.
2. Areas to be sodded shall be top-soiled to a minimum depth of six in. (6”), compacted measure. Provide additional topsoil depths as required to construct the grades indicated on the Drawings. Topsoil shall be compacted to 85%, determined in accordance with ASTM: D 1557. Onsite topsoil is to be used unless it is not available, or is more than 25% clay, or is more than 10% limestone, or is rocky.

C. Fertilizing for Sod Areas:

1. Till specified fertilizer (along with any amendment) into the top 1” of area to receive sod. Work fertilizer into the soil to a depth of ½”-1” after fine grading & not more than 2 days prior to grass planting. Cultivating equipment shall be set so the fertilizer will not penetrate the soil more than 1 inch. Do not apply fertilizer when there is a possibility of rain before lawn areas can be sodded.
2. Uniformly distribute granular Sod Fertilizer (See Section 2.2 M) by mechanical means at the rate of 1200 lbs. per acre or 28 lbs. per 1000 sq. ft.
3. Irrigate soil after fertilizer application and 1- 4 hours prior to laying sod.

3.05 SODDING

A. Weather Conditions

1. Schedule work for periods of favorable weather.

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2. Do not place Sod on days that, in the judgment of the Landscape Architect, are too hot, sunny, dry, cold, wet, or windy for optimal growth.

B. Placement Pattern

1. The first row shall be laid in a straight line with subsequent rows parallel to the first row and tightly abutting each other.
2. Lateral joints shall be staggered. Care shall be exercised to ensure that the sod is neither stretched nor overlapped. Joints must be butted tightly to prevent voids that could permit air to dry out roots.
3. Immediately after placing, sod shall be pressed firmly into contact with sod bed by tamping or rolling to eliminate air pockets.
4. When on slopes steeper than 4 to 1, sod shall be secured by galvanized pins, wood pegs or other methods approved by the Landscape Architect.
5. Sand joints and top dress turf with topdressing sand as necessary to provide a smooth uniform finished surface.
6. Immediately after sodding operations have been completed, entire surface shall be compacted with a roller or other approved equipment. The completed area after sodding shall be uniformly even, firm, and true to finished grade lines.

C. Rolled Sod

1. For sports fields, or if called out on plans, use rolled solid sod.
2. Runs of rolled sod shall be maximized to minimize small pieces. Lay sod to avoid small or skinny pieces.
3. A bobcat and/or tractor with extra-wide tires and a “big roll” attachment shall be used to lay the rolls of sod.
4. Plastic netting shall be removed as sod is rolled out and properly disposed of upon installation as shown in the following photo:



D. Watering:

1. Provide an adequate supply of water to keep the sod thriving at the site prior to and during transplanting of the sod.

3.06 CLEAN-UP

A. After all planting operations have been completed, remove all trash, excess soil, empty plant containers, pallets, ties, rubbish, and all debris associated with this contract from the site. All scars, ruts, trench settlement, or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site. The Contractor

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shall pick up all trash resulting from this work no less frequently than each Friday before leaving the site, once a week, or the last working day of each week. All trash shall be removed completely from the site.

B. The Contractor shall leave the site area broom-clean and shall wash down all paved areas within the Contract area, leaving the premises in a clean condition. All walks shall be left in a clean and safe condition.

C. Excess topsoil not required for lawns or planting shall be stockpiled on site for future use as directed by the Owner's representative.

D. Repair existing lawns damaged by operations under the contract. Repair shall include finish grading and sodding as required to match existing grade and lawn, and maintenance of repaired areas.

3.07 OBSERVATION SCHEDULE

A. The Contractor shall be responsible for notifying the Landscape Architect in advance for the following site visits, according to the time indicated:

1. Pre-job Conference - 7 days
2. Final grade review - 2 days
3. Sod material review - 2 days
4. Soil Preparation and planting operations - 2 days
5. Pre-maintenance - 7 days
6. Final inspection - 7 days

B. When observations are conducted by someone other than the Landscape Architect, the Contractor shall show evidence, in writing, of when and by whom these observations were made.

C. NO site visits shall commence without all items noted in previous Observation Reports either completed or remedied unless such compliance has been waived by the Owner. Failure to accomplish punch list tasks or prepare adequately for desired inspections shall make the Contractor responsible for reimbursing the Landscape Architect at his current billing rates per hour, portal to portal (plus transportation costs) for the inconvenience. NO further inspections shall be scheduled until this charge has been paid and received.

3.08 GUARANTEE

A. All plant material shall be guaranteed by the contractor for a period of one (1) year from the date of final acceptance.

B. At the end of the guarantee period the Landscape Architect and Contractor shall inspect plant material. Any plant material under this contract that is dead or of an unsatisfactory growth condition shall be removed and replaced in a timely fashion by the contractor, at no cost to the owner.

3.09 ACCEPTANCE OF WORK

A. The contractor and Landscape Architect shall conduct an on-site inspection of all work and materials to determine compliance of work with the construction documents.

B. The contractor shall, within reasonable means, provide the Landscape Architect with sufficient data to demonstrate compliance with the construction documents.

C. The contractor shall be notified in writing of any non-conforming items, which are to be corrected (punch-list).

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D. The contractor and Landscape Architect shall conduct an on-site inspection to verify completeness of punch list items.

E. Acceptance of work by the Owner shall begin upon verifying completion of punch list items and receipt of all deliverable items to Owner including letter of guarantee; release of liens waiver, record drawings denoting deviations from contract drawings, product data and maintenance guide.

F. The contractor shall receive written notification of date of final acceptance and ending date of required guarantee periods from the Landscape Architect.

3.10 90 DAY MAINTENANCE

A. The maintenance period shall commence when the Notice of Substantial Completion is issued and shall continue as required for a period of 90 days.

B. Contractor shall be responsible for all costs associated with establishment during the maintenance period to include, but not be limited to: cost of water, electricity, fertilizer, replacement materials, equipment, transportation, and labor, etc.

C. Immediately after sodding, the area shall be protected against traffic or other use by erecting barricades as needed, and by placing approved warning signs at appropriate intervals.

D. Contractor shall touch-up sod areas as required to achieve 100% coverage at no cost to Owner.

E. Mow turf grasses only (not wildflower or native grass areas) during establishment only for the purpose of weed control and to promote quicker spreading.

1. Mow Bermuda and Zoysia Grass to a 2” height.
2. Mow St Augustine Grass to a 4” height.
3. Mow at least once a week in the growing season once turf is rooted and growing.

F. Fill any depressions, settlement, or washouts that occurs within 90 days following installation. Re-sod bare spots that occur during the maintenance period as directed by the Landscape Architect at no cost to Owner.

G. Keep lawns clean and protected from damage during the maintenance period. Debris that accumulates shall be removed from the site. Promptly repair damaged lawns except as provided in Section 1.9, GUARANTEE AND REPLACEMENT.

H. Irrigate as required to supplement natural rainfall so that all lawn areas receive sufficient water for normal plant growth. Furnish all irrigation equipment needed for watering and be responsible for securing adequate supply of water if an automatic irrigation system does not exist, is not operating or is damaged.

I. Turf areas are to be maintained so as to be 98% (minimum) weed-free. If live perennial or annual weeds appear within sod areas, remove them mechanically or spray them with a selective and systemic contact herbicide, as recommended and applied by an approved, licensed landscape pest control applicator. Leave sprayed plants intact for at least fourteen (14) days to allow systemic kill. Reapply at 2-week intervals until a complete kill is achieved while being careful not to damage surrounding turfgrass. Maintain the site weed-free until final acceptance by the Landscape Architect, utilizing mechanical and chemical treatment.

J. A second fertilizer application shall be made 60 days after installation to turfgrasses. The specified fertilizer (see section 2.1.L) shall be applied at 800 pounds per acre or 18 lbs. per 1,000 SF.

END OF SECTION

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SECTION 333000
SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established in the North Central Texas Council of Governments (NCTCOG) Standard Specifications for Public Works Construction, City/County and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Work Included:
   1. Installation of pipe material.
   2. Construction of manholes.
   3. Connection to existing sewer system.

B. Related Work Specified on Other Sections
   1. Section 31 2333 - Trenching and Backfilling
   2. Section 33 0000 - Earthwork

1.03 COORDINATION

A. Verify flowline elevation at connection to existing manhole; notify architect if elevation is more than 0.1’ above plan elevation.

B. Coordinate installation with other construction throughout the site.

C. All construction shall conform to NCTCOG and applicable City/County Standard Specifications for Construction.

1.04 REFERENCES

A. ASTM D3034: Specifications for PVC Sewer Pipe 4” through 15” in diameter.

B. ASTM D2321: Practice for Installation of Underground Installation

1.05 SUBMITTALS

A. All pipe and fittings not covered by this specification shall be approved by the engineer seven days prior to bid.

PART 2 - PRODUCTS

2.01 PIPE

A. Polyvinyl Chloride (PVC) sewer pipe and fittings with dimension control.
   1. Pipe shall be SDR-26 or SDR-35 per plans.
   2. Pipe Fittings: Pipe fittings shall conform to ASTM D1784. Fittings approved by the Engineer shall also be acceptable.
   3. Balance of specifications shall be covered by Item 501.17 per NCTCOG.

2.02 STRUCTURES

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A. Materials for the construction of manholes shall be as specified in Division 700, “Concrete Structures” of the NCTCOG’s Standard Specifications for Construction.

PART 3 - EXECUTION

3.01 GENERAL

A. The locations of all structures and lines and grades of all pipes shall be staked by a registered surveyor. All facilities shall be located according to the site layout plans.

B. Contractor shall utilize necessary measures including temporary pumping and collection until the public sewer improvements are installed and operational.

3.02 PIPES

A. All pipe shall be inspected prior to installation. Damaged pipes shall not be used. Replacement of damaged pipe shall be made by the Contractor at no expense to the owner.

B. Installation shall be in accordance with NCTCOG and City/County specifications and as recommended by the pipe manufacturer. Backfill shall be per plans.

3.03 STRUCTURES

A. Construction of manholes shall be as specified in Division 700, “Concrete Structures” of NCTCOG and the City’s/County’s Standard Specifications for Construction.

B. Connections of pipe to structures shall be completely mortared around the perimeter of the pipe to ensure connection to the structure prior to backfilling. Pipe shall have a rubber boat placed over the end prior to pouring concrete structure or grouting.

C. All manholes in pavement areas shall be held below pavement and the frame/lid shall be adjusted to final grade with grade rings. There should be no abrupt grade changes at manholes rims. **If abrupt grade changes are present, grade adjustments will be required.**

END OF SECTION

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SECTION 334000
STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Provisions established within the General and Supplementary General Conditions of the Contract, Division 1 - General Requirements, and the Drawings are collectively applicable to this Section.

1.02 SUMMARY

A. Work Included:
   1. Installation of pipe material.
   2. Construction of drainage system structures including curb inlets, junction boxes and catch basins.
   3. Ditch-out for storm drainage system discharge.

B. Related Work Specified in Other Sections
   1. Section 31 2333 - Trenching and Backfilling
   2. Section 31 0000 - Earthwork

1.03 COORDINATION

A. Contractor shall coordinate installation of drainage system with other construction throughout the site.

B. All construction shall conform to applicable City/County Specifications for Construction.

C. All work of this Section shall be completed within the limits of the site property boundary or designated offsite easements.

1.04 REFERENCES

A. ASTM C76: Specification for Reinforced Concrete Pipe

B. AASHTO M294 HDPE Pipe

C. ASTM F477 HDPE Fittings

1.05 SUBMITTALS

A. All pipe and fittings not covered by this specification shall be approved by the engineer seven days prior to bid.

PART 2 - PRODUCTS

2.01 PIPE

A. Reinforced concrete pipe shall be Class III.

B. Plastic pipe shall be PVC SDR35 or Schedule 40 or HDPE heavy wall meeting the requirements of AASHTO M294 and ASTM F477 with corrugated exterior with smooth lined interior. All pipe joints and fittings shall be watertight.

C. ADS HP Storm polypropylene pipe (dual wall) meeting the requirements of AASHTO M330, and ASTM F2881 with smooth inner wall and annular exterior corrugations.

2.02 DRAINAGE STRUCTURES

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A. Materials for the construction of inlets and junction boxes shall be as specified in Division 7, "Structures" of the NCTCOG's Standard Specifications for Construction.

PART 3 - EXECUTION

3.01 GENERAL

A. The locations of all structures and lines and grades of all pipes shall be staked by a registered surveyor. All facilities shall be located according to the site layout plans.

B. Contractor shall utilize necessary measures, including temporary pumping in order to drain storm water offsite until the public drainage improvements are installed and operational.

3.02 PIPES

A. All pipes shall be inspected prior to installation. Damaged pipes shall not be used. Replacement of damaged pipe shall be made by the Contractor at no expense to the owner.

B. Installation shall be in accordance with ASTM D2321 and as recommended by the pipe manufacturer. Backfill shall be ASTM D2321 Class I, II or III soils.

C. Pipe installation shall conform to the North Central Texas Council of Governments (NCTCOG) Standard Specifications for Public Works Construction.

3.03 DRAINAGE STRUCTURES

A. Construction of curb inlets tops and catch basins in pavement areas shall be **cast-in-place only** with **no precast structures allowed**. All manholes in pavement areas shall be held below pavement and the frame/lid shall be adjusted to final grade with grade rings. There should be no abrupt grade changes at manholes rims. **If abrupt grade changes are present, grade adjustments will be required.** Catch basins and headwalls outside of pavement areas shall be either cast-in-place or precast.

B. Connections of pipe to structures shall be completely mortared around the perimeter of the pipe to ensure watertight connection to the structure prior to backfilling. All bends and tees shall be precast/preformed.

C. Inlet top and throat shall be poured once pavement improvements are in place.

END OF SECTION

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