HAYS COUNTY ESD #4

FIRE STATION #42

PROJECT MANUAL

Project No.
CSP #2026-01

ISSUE FOR BIDDING
SPECIFICATIONS



martinez
ARCHITECTS

PROJECT MANUAL

CSP #2026-01

October 21, 2026

HAYS COUNTY ESD 4

PROPOSED FIRE STATION NO. 42

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MEP Engineer

Emerald MEP

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1.01 THE FOUNDATION INVESTIGATION REPORT

A. The Geotechnical Report Entitled: Geotechnical Investigation based on the following soil report:

1.02 TERRACON – PROJECT NO. 96255246 – DATED 03/16/2025

A. Complete copies of the Geotechnical Reports are attached herein. They are provided for reference and to familiarize the contractor with minimum project requirements. The drawings and specifications govern the construction of the project. In the event that specific design criteria is not indicated in the drawings or specifications, the recommendations provided in the Geotechnical Report shall be utilized, but in no way shall the proposed design be less than the minimum requirements contained in the Geotechnical Report. Prior to commencement of work, notify the Architect of any discrepancies between the drawings, or specifications, and the Geotechnical Report to determine appropriate course of action.

B. The Contractor is hereby advised to review the Geotechnical Report and visit the site to ascertain the conditions affecting the Work. In the event of discrepancies between the Drawings, Specifications, and Geotechnical Report, the Geotechnical Report shall take precedence. In the absence of a Geotechnical Report, discrepancies between Drawings and Specifications shall be brought to the attention of the Architect for resolution. Failure to review the Geotechnical Report and report discrepancies, between the Geotechnical Report, if any, and Drawings and Specifications, to the Architect will not relieve the Contractor from the responsibility to perform the work required by such documents, at no additional expense to the Owner.

1.03 SOIL CONDITIONS

A. The conditions indicated in the report were known to exist at the location shown on the date the tests were performed; however, these boring logs are for the Contractor’s consideration only, and he shall visit the site and fully acquaint himself with the existing conditions and be prepared to complete all work required by the documents.

END OF SECTION 00 31 32

Wimberley Fire/Hays - ESD 4

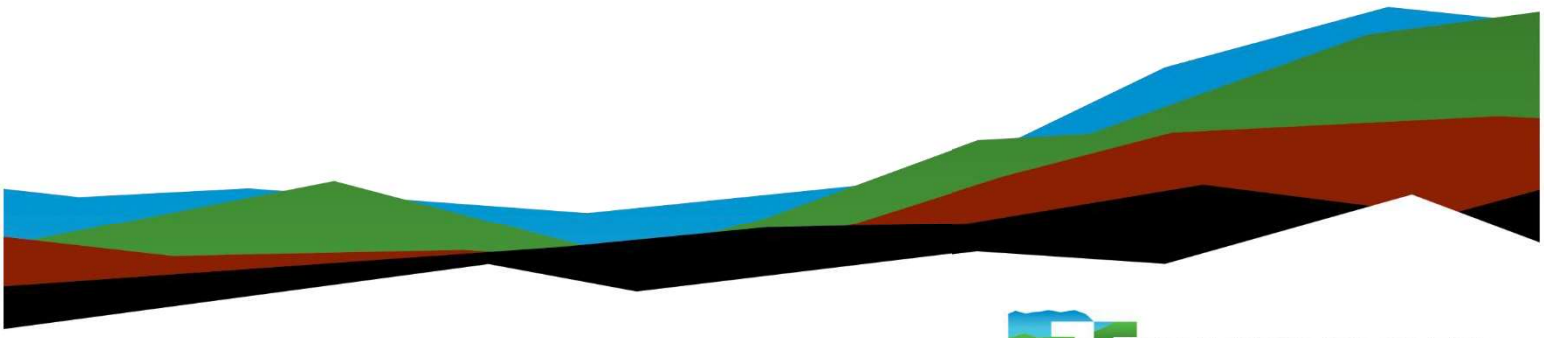
Geotechnical Engineering Report

Wimberley, Texas

March 16, 2025 | Terracon Project No. 96255246

Prepared for:

Rosborough Project Management
LLC
1900 Estrellita Ranch Rd
Canyon Lake, TX 78133



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5307 Industrial Oaks Boulevard, Suite 160
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P (512) 442-1122
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March 16, 2025

Rosborough Project Management LLC
1900 Estrellita Ranch Rd
Canyon Lake, TX 78133

Attn: Ryan Rosborough
P: (361) 816-2468
E: ryan@rosboroughpm.com

Re: Geotechnical Engineering Report
Wimberley Fire/Hays - ESD 4
16500 Ranch Road 12
Wimberley, Texas
Terracon Project No. 96255246

Dear Mr. Rosborough:

We have completed the scope of Geotechnical Engineering services for the above referenced publicly funded project in general accordance with Terracon Proposal No. P96255246 dated December 4, 2025. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork, foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.
TBPELS Firm Registration TX-F3272

Leila Roshanali, E.I.T.
Staff Engineer

For
Edward E. Jaimes, P.E.
Manager Regional Services; Geotechnical

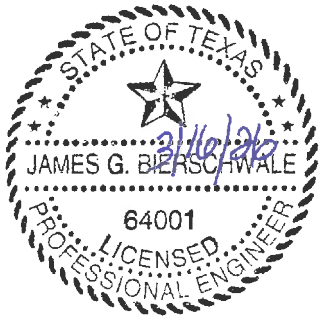


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Exploration and Testing Procedures
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Note: This report was also delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed Wimberley Fire/Hays - ESD 4 to be located at 16500 Ranch Road 12 in Wimberley, Texas. The purpose of these services was to provide information and geotechnical engineering recommendations related to:

- Subsurface soil and rock conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Foundation design and construction
- Floor slab design and construction
- Lateral earth pressure
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of test borings, laboratory testing, engineering analysis, and preparation of this report.

Drawings showing the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included in the boring logs in **Exploration and Laboratory Results**.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	An email request for proposal was provided by Ryan Rosborough on November 21, 2025. The request included a site plan.
Project Description	We understand that the project consists of a 14,500 square foot Emergency Services District building along with associated pavement areas.

Item	Description
Building Construction	Based on the information provided, we assumed that the building will be steel frame supported on a shallow foundation system.
Finished Floor Elevation	Finished floor elevation(s) were not provided. However, we assumed FFE to be within 2 feet of existing grades.
Maximum Loads	Anticipated structural loads were not provided. In the absence of information provided by the design team, we used the following loads in estimating settlement based on our experience with similar projects. ▪ Columns: 75 to 100 kips ▪ Walls: 2 to 4 kips per linear foot (klf) ▪ Slabs: 150 pounds per square foot (psf)
Gradings	Grading information was not provided to, however we anticipate grade changes may consist of up to 10 feet.
Below-Grade Structures	None.
Free-Standing Retaining Walls	Some retaining walls up to 5 feet tall are anticipated.
Pavements	Based on its intended use, we are providing recommendations for concrete pavements. For concrete pavements (PCC), we assumed traffic would consist of the following American Concrete Institute (ACI) categories: ▪ Category A: Car parking areas and access lanes, up to 1 truck per day ▪ Category B: Entrance and truck service lanes, up to 10 trucks per day ▪ Category E: Garbage or fire truck lanes, based on our experience with projects of this nature we assumed up to 20 calls per day and a 75,000 pound fire engine A pavement analysis period of 20 years was used.

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project site is an approximately 0.20-acre tract of land located at 16500 Ranch Road 12 in Wimberley, Texas. Latitude/Longitude (approximate): 30.0305 °N, 98.1014 °W See **Site Location**
Existing Improvements	Existing stone building and a water well.
Current Ground Cover	Earthen soils and grass, lightly vegetated with trees, asphalt and concrete pavements.
Existing Topography	Not provided but based on Google Earth data, the site slopes from a high elevation of about 1040 feet down to approximately 1019 feet.

Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of the site. Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in **Exploration and Laboratory Results** and the GeoModel can be found in **Figures**.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel. Throughout this report, the terms GeoModel Layer and Stratum are synonymous and used interchangeably.

Model Layer	Layer Name	General Description
1	**Surficial Soils**	Dark brown fat clay (CH) with various amounts of sand and gravel, with organics, hard.
2	**Residual Soils**	Varies from sandy lean clay (CL) with various amounts of gravel to silty clayey sand (SM) to clayey sand with gravel (SC).

3	**Limestone**	Pale brown to tan Glen Rose Formation Limestone, moderately to intensely fractured, with clayey seams and layers, slightly vuggy.

Groundwater

The borings were advanced using solid-stem augers that allow short-term groundwater observations to be made while drilling and at completion of drilling. Groundwater seepage was not encountered within the maximum drilling depth at the time of our field exploration. However, this does not necessarily mean no groundwater may be present at the site as groundwater conditions can (and likely will) vary between the time of the geotechnical investigation and the timeframe of construction activities.

Although not observed, groundwater seepage is possible at this site, particularly in the form of seepage traveling along pervious seams/fissures in the soil, along the soil/limestone interface and/or in fissures/fractures in the limestone.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. Therefore, the possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

A relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. Long term observations (which were outside the scope of services for this project) in piezometers sealed from the influence of surface water are often required to define groundwater levels in materials of this type. Please contact us if this is desired. Groundwater conditions should be evaluated immediately prior to construction.

Geologic Hazards

Although solution cavities and voids are not very common in the Glen Rose Formation, they can occur and can impact construction. Some vugular features were encountered in the Stratum 3 limestone during our drilling operations. If voids or other significant solution features are encountered during site preparation/excavation operations, Terracon should be contacted to evaluate the feature from a geotechnical engineering perspective. For most features, filling or grouting the void with concrete would be appropriate to minimize the potential for water/material migration into the feature once construction has been completed.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil/bedrock properties observed at the site and as described on the exploration logs and results, our professional opinion is that a **Seismic Site Classification of B** may be considered for the project. Subsurface explorations at this site were extended to a maximum depth of 15 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

The near-surface soils could become problematic with typical earthwork and construction traffic, especially after precipitation events. Thus, effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. Additional site preparation recommendations, including subgrade improvement and fill placement, are provided in the **Earthwork** section.

Based on our test borings, the on-site soils exhibit a low potential for volumetric change during moisture variations and exhibited minimal thickness. Based on existing grades and dry conditions, the soils at this site exhibit a Potential Vertical Rise (PVR) of up to about 1-inch, as estimated by the TxDOT Method 124-E.

The buildings may be supported on a spread/continuous footing foundation system bearing in either compacted and tested select fill, Stratum 2 soils or on top of the Stratum 3 bedrock. The **Shallow Foundations** section addresses support of the building directly bearing on a spread/continuous footing foundation system. Alternatively, if preferred, the building may be supported on drilled piers bearing into Stratum 3 Limestone which is addressed in the **Deep Foundations** section.

The **Floor Slabs** section addresses slab-on-grade support of the building using overexcavation techniques. Lateral earth pressures and drainage considerations are

provided for conventional site retaining walls in the **Lateral Earth Pressures** section. The **Pavements** section includes minimum pavement component thicknesses.

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration and Laboratory Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Earthwork is anticipated to include clearing and grubbing, excavations, and engineered fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for construction of foundations, floor slabs, pavements, and general site improvements.

Demolition

The proposed building will be constructed within the footprint of the existing stone structure. We recommend existing foundations, slabs, and utilities be completely removed from within the proposed building footprints to a depth of at least 2 feet below finished grade and to a lateral distance of at least 5 feet beyond the outer edge of foundations. If utilities are planned to be abandoned in place as an alternative to removal, the utility piping should be filled with flowable fill (TxDOT Item No. 401) and plugged such that it does not become a conduit for water flow or a potential voided area.

Site Preparation

Prior to placing fill, existing vegetation, topsoil, loose soil, and root mats should be removed. Complete stripping of these materials should be performed in the proposed structure and pavement areas.

Site stripping and/or excavation operations could loosen limestone rocks which should either be properly broken down or removed from the site.

Trees are located within or near the footprint of the proposed building, which will require removal at the onset of construction. Tree root systems can remove substantial moisture from surrounding soils increasing additional risk for moisture fluctuations and pavement distress. The area affected by trees is typically related to the lateral extent of their root systems. Pavements constructed over or in proximity to tree roots may experience cracking (e.g., longitudinal and/or concentric) and settlement (e.g., depressions and low

spots) due to shrink/swell of the soils caused by fluctuations in soil moisture levels. Where trees are removed, the full root ball and all associated dry and desiccated soils should be removed. The soil materials which contain less than 5 percent organics can be reused as engineered fill provided the material is moisture conditioned and properly compacted as recommended in this report.

Where fill is placed on existing slopes steeper than 5H:1V, benches should be cut into the existing slopes prior to fill placement. The benches should have a minimum vertical face height of 1 foot and a maximum vertical face height of 3 feet and should be cut wide enough to accommodate the compaction equipment. This benching will help provide a positive bond between the fill and in-situ soils and reduce the possibility of failure along the fill/in-situ soil interface.

As an alternative to benching, a "keyed-in toe" could be considered. The keyed-in toe should consist of a minimum 12-foot-wide section excavated into the subgrade such that a horizontal working surface is attained for compaction of the first embankment lift. Successive lifts should remain horizontal and not tend to follow the slope of the natural subgrade.

Although no evidence of fill or underground facilities (such as septic tanks, cesspools, basements, and utilities) was observed during the exploration and site reconnaissance, such features could be encountered during construction. If unexpected fills or underground facilities are encountered, such features should be removed, and the excavation thoroughly cleaned prior to backfill placement and/or construction.

Excavation

Excavation operations deeper than 2 feet will penetrate into the Stratum 3 limestone. While the on-site soils should be relatively easy to excavate in comparison to the underlying limestone, there is a possibility of encountering limestone cobbles, boulders, seams, and layers within the soils. Based on the encountered subsurface conditions, our past experience with the Stratum 3 limestone, and the data obtained during our field and laboratory programs (average compressive strength of 4,000 psi), it is our opinion heavy-duty construction equipment, such as a hoe ram, a heavy dozer equipped with a ripper, a rock saw or jack hammer or with rock trenching equipment, will be required for grading, shallow excavations, and utility trench excavations that penetrate the Stratum 3 limestone.

Please note that Stratum 3 limestone was encountered at varying depths across the site. The weathering profile of limestone can be unpredictable. The Contractor should be prepared to encounter and properly excavate near-surface limestone anywhere on this site.

Our comments on excavation are based on our experience with the rock formation. Rock excavation depends on not only the rock hardness, weathering, and fracture frequency, but also the contractor's equipment, capabilities, and experience. Therefore, it should be the contractor's responsibility to determine the most effective methods for excavation. The above comments are intended for information purposes for the design team only and may be used to review the

Subgrade Preparation

The exposed final subgrade (including the excavation required for the building pads) in all construction areas (can be omitted in landscaping areas) should be proof rolled with an adequately loaded vehicle such as a 20-ton pneumatic roller, a fully loaded tandem-axle dump truck or similar vehicle. The proof rolling should be performed under the observation of the Geotechnical Engineer or representative. Areas excessively deflecting under the proof roll should be delineated and subsequently addressed. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted.

After proofrolling and just prior to placement of fill, the exposed subgrade in all construction areas (may be omitted in landscaping areas) should be evaluated for moisture and density through field density testing. If the moisture and/or density testing results do not meet the moisture and density requirements below, the subgrade should be scarified to a minimum depth of 6 inches, moisture conditioned and compacted as per the fill compaction requirements in **Fill Placement and Compaction Requirements**. Field density testing does not need to be performed in exposed Stratum 3 limestone subgrade areas, provided the Stratum 3 limestone is proofrolled.

Compacted select/structural fill and pavement fill soils should then be placed to the proposed design grade and the moisture content and compaction of the soils should be maintained until foundation, floor slabs, and/or pavement construction.

Information about the existing and proposed grades have not been provided to Terracon at this time. However, we assume that the planned FFE's are with about 1 to 2 feet of existing grades. If these assumptions are incorrect, Terracon should be notified to review and modify or verify the recommendations in writing.

For the proposed buildings, we recommend that the entirety of the on-site Stratum 1 dark brown soils be excavated and removed from the building area. A minimum of 18 inches of properly compacted select fill should be placed in all building areas. In areas where the Stratum 3 limestone is encountered, the excavation may be shallowed provided at least 12 inches of properly compacted select fill is placed in all building areas. All fill within building areas must be select fill. A modulus of subgrade reaction of 100 pci may be used if these recommendations are followed.

The above subgrade preparation recommendations should be applied to an area extending a minimum of 5 feet outside of building areas including attached walkways and any other architectural members. We suggest the use of crushed limestone base in the upper 6 inches of the select fill pad from a standpoint of construction access during wet weather, as well as from a standpoint of floor slab support.

For any movement-sensitive flatwork (sidewalk, ramps, etc.) outside of the building areas, subgrade preparation as discussed above should be considered to reduce differential movements between the flatwork and the adjacent building. If subgrade preparation as given above for building areas is not implemented in the exterior flatwork areas, those areas may be susceptible to post-construction movements in excess of that given above.

The potential movement values indicated are based upon moisture variations in the subgrade due to circumstances such as moisture increases due to rainfall and loss due to evapotranspiration. In circumstances where significant water infiltration beneath the floor slab occurs (such as a leaking utility line or water seepage from outside the buildings resulting from poor drainage), movements in isolated floor slab areas could potentially be in excess of those indicated in this report.

The post-construction performance of the foundation will likely be influenced more by post-construction volumetric changes of the subgrade due to in-situ moisture variations than upon settlement due to foundation loads. Settlement response of select fill supported slabs will be influenced as much by the quality of construction and fill placements as by soil-structure interaction. Therefore, it is essential that the recommendations for foundation construction be strictly followed during the construction phases of the building pad and foundation.

Temporary Groundwater Control

Although not encountered during our drilling operations, groundwater seepage could be encountered during construction. The volume of groundwater seeping/flowing into the excavation will vary based on rainfall patterns before and during construction. Temporary groundwater control during construction would typically consist of perimeter gravel-packed drains sloping toward common sump areas for groundwater collection and removal. Placement of drain laterals within the excavation could be required to remediate isolated water pockets.

Fill Material Types

Engineered fill required to achieve design grade should be classified as select/structural fill or paving/genera fill. Select/structural fill is material used below and within 5 feet of

structures. Paving/General fill is material used to achieve grade in paving, non-reinforced earthen slopes, landscaping, or other general (non-structural) areas.

Material property requirements for on-site soil for use as select/structural fill and general/paving fill are noted in the table below:

Soil Type [1]	USCS Classification	Acceptable Specifications
Select Fill [2,3]	CL, SC, GM, GC	▪ TxDOT Item 247, Type A, Grade 3 or better, OR ▪ Soils with 7≤PI≤20, ≤40% retained on No. 4 sieve, and rocks ≤ 4 inches in maximum dimension
Paving/General Fill[4]	CH, CL, GM, GC, SC	▪ Soils with PI ≤ 25; and rocks ≤ 4 inches in maximum dimension

1. Select and paving/general fill should consist of approved materials free of organic matter and debris. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. As an alternative to the Acceptable Specifications above, a low plasticity granular material which does not meet the specifications above may be used only if approved by Terracon.
3. The on-site Stratum 1 dark brown soils are not suitable for re-use as select fill. The excavated Stratum 2 pale brown residual soils may be acceptable for re-use if it meets one of the Acceptable Specifications above for Select Fill. The Stratum 3 bedrock materials should be acceptable for re-use as select fill if it is processed such that it meets one of the Acceptable Specifications above for Imported Select Fill. Please note that removal of higher plasticity soils (typically dark brown to brown in color) will be necessary to maintain plasticity indices of the material within acceptable range. In some situations, the difference between more highly plastic clay, lower plasticity silty soils, and appropriate material may not be readily distinguishable without the performance of appropriate lab testing.

   It has been our experience that proper processing of excavated limestone often involves such processes as breaking down of larger rock with equipment, screening, removal of more highly plastic clay layers, etc. The Contractor's proposed methods of processing these materials should be reviewed prior to initiation of construction to check that these methods will produce an acceptable select fill material. The relative ease of mining and segregating the materials is unknown at this time.
4. Excavated on-site soils, if free of organics, debris, and rocks larger than 4 inches may be considered for re-use as fill in pavement, landscape, or other general areas. Please note that the on-site soils exhibit high to very high

shrink/swell potential. For economic reasons, expansive soils are often used in pavement and/or flatwork areas. The owner should be aware that the risk exists for future movements of the subgrade soils which may result in movement and/or cracking of pavement and/or flatwork.

Fill Placement and Compaction Requirements

Engineered fill should meet the following compaction requirements.

Material Type		Maximum Lift Thickness	Minimum Compaction Requirements (%) [1]	Water Content Range (%) [1]
Select Fill		≤ 8 inches in loose thickness when heavy, self-propelled compaction equipment is used ≤ 6 inches in loose thickness when hand-guided equipment (i.e., jumping jack or plate compactor) is used	95 [2]	-3 to +3
Moisture Conditioned Building Subgrade, Paving Fill, Paving Subgrade, and General Fill	PI ≤ 25		95	-3 to +3
	PI > 25		95	Optimum to +4
Crushed Limestone Base (beneath pavements) [3]			100 [3]	-3 to +3 [3]
Granular Wall Backfill (SP, SW, GP, GW)		12 inches	See Note Below [4]	See Note Below [4]

1. Maximum dry unit weight and optimum water content as determined by the standard Proctor test (ASTM D 698).
2. **For fills thicker than 5 feet, if any, the compaction should be increased to at least 100 percent of the ASTM D 698 maximum dry unit weight.**
3. Per TEX-113-E.
4. For the site retaining walls, granular backfill can be considered. If a free draining granular material is placed, the granular material should be compacted using hand guided equipment. A visual indicator should be placed on the adjacent wall corresponding to the loose lift height. The backfill must then be compacted until no further compaction/densification of the backfill is visually observed. Subsequent lifts can continue after.

Cut Slopes

The table below provides the recommended slope inclinations for both permanent cut slopes and temporary cut slopes. In our opinion, cut slopes at the inclinations discussed below should be stable against a large-scale slide, however the potential for sloughing of loose soils zones exists.

Slope Type[1,2]	Maximum Slope Inclination
Temporary	Per OSHA guidelines and standards
Permanent	3(H):1(V) in Stratum 1/2 soils or imported compacted soil fill 2(H):1(V) in Stratum 3 weathered limestone bedrock 1(H):1(V) in Stratum 3 limestone bedrock

1. If steeper slopes are planned for final grading, then additional services will be required by Terracon to perform detailed slope stability analyses.
2. For slopes to be used by mowers or other maintenance equipment, 4H:1V slopes or flatter are generally preferable.

Exposed cut slopes will also be susceptible to further erosion due to the nature of the on-site soils and limestone. Installation of erosion control measures in such areas would be beneficial in reducing the potential slope stability which could result from excessive erosion. In addition to initial erosion control measures, the cut slopes should be periodically checked for erosion (particularly after heavy rainfall events) and maintenance performed on areas exhibiting erosion.

In regard to worker safety, Occupation Safety and Health Administration (OSHA) Safety and Health Standards require the protection of workers adjacent to excavations. The OSHA guidelines and directives should be adhered by the Contractor during construction to provide a safe working environment.

Buffer Zones Adjacent to Cut Slopes

Excavation methods which fracture the limestone significantly could result in decreased slope stability. To allow for some sloughing to occur, we recommend that a "buffer zone" at least 5 feet wide adjacent to pavement and other general areas be provided between the proposed construction areas and the permanent cut slopes (both at the toe and the crest). If structures are planned near these areas, the buffer zones should be increased to at least 10 feet. This should help reduce the possibility of sloughing soils/rock from contacting the adjacent improvements on the downhill side and from undermining the improvements on the uphill side.

Embankment Fill Slopes

The table below provides the recommended slope inclinations for embankment fill slopes which are constructed in association with the substation, pavement, and/or general site improvements.

Slope Type	Maximum Slope Inclination
Embankment Fill Slopes [1,2]	3(H):1(V) for on-site soils or imported compacted soil fill [3]

1. For slopes to be used by mowers or other maintenance equipment, 4H:1V slopes or flatter are generally preferable.
2. Fill placement for the embankments should proceed as outlined in **Earthwork**.
3. If steeper slopes are planned for final grading, then additional services will be required by Terracon to performed detail slope stability analyses.

The embankment slopes should be properly protected from erosion. The use of rock rip-rap, erosion control fabrics, and/or vegetation is common. In addition to initial erosion control measures, the embankments should be periodically checked for erosion (particularly after heavy rainfall events) and maintenance performed on areas exhibiting erosion.

Embankments which are constructed on natural subgrade sloping steeper than 5(H):1(V) should be "keyed" into the subgrade at the toe of the embankment. The keyed-in toe should consist of a 12-foot-wide section which is excavated into the subgrade such that a horizontal working surface is attained for compaction of the first embankment lift. Successive lifts should remain horizontal and should not tend to follow the slope of the natural subgrade.

The edges of fill embankments are often undercompacted in the field due to loose material being pushed off the edges as the embankment lifts are compacted. To reduce the possibility of this impacting the stability of the embankment fill, the embankments should be overbuilt and compacted as outlined in **Earthwork**. Then the embankment should be cut back to the slopes recommended above.

Interceptor Drains

The geologic and topographic setting of this site creates a concern of possible infiltration of groundwater seepage into the proposed improvements, particularly in cut areas that expose the Stratum 3 limestone. Installation of perimeter interceptor trenches/drains (commonly referred to as French drains) should be installed at the base of retaining walls and where cuts expose limestone adjacent to the building to intercept and remove groundwater before it has an opportunity to infiltrate into the adjacent improvements.

Groundwater encountered at the site during construction could be diverted with interceptor trenches/drains along the uphill sides of the proposed improvements. In areas where groundwater seepage occurs before or during construction, installation of such drains is highly recommended. If no such seepage occurs before or during construction, drain installations could be considered optional. However, drain installations will likely be more expensive and more intrusive to the constructed facilities if drains are installed after construction is completed.

In general, drains should extend at least 18 inches below the adjacent lowest grades and at least 18 inches below the building slab near the lowest part of the drain. The drain system should be designed to gravity flow and outlet down and away from the adjacent improvements. The drains should consist of a clean, washed, gravel section (at least 18 inches wide) meeting the gradation requirements of ASTM C 33, Grade 57 (or similar), continuously wrapped in filter fabric (Mirafi 140N or equivalent). Perforated collector pipes should be provided for all drains. Terracon would be pleased to review the actual location, depth, and cross-sections of the drains with the other Design Team members prior to construction.

Because of the geologic and topographic setting of this site, groundwater seepage is likely to occur in cut areas that expose the Stratum 3 limestone. Thus, the installation of interceptor trenches/drains should be strongly considered where cut slopes are proposed to expose limestone bedrock.

Grading and Drainage

The performance of the proposed structure will not only be dependent upon the quality of construction, but also upon the stability of the moisture content of the near surface soils. Therefore, we highly recommend that site drainage be developed so that ponding of surface runoff near the structure does not occur. Accumulation of water near the structure may cause significant moisture variations in soils adjacent to the structure, thus increasing the potential for structural distress.

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building or discharged on to positively sloped pavements.

Exposed ground should be sloped and maintained at a minimum 5% away from the building for at least 10 feet beyond the perimeter of the building. Flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document

effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with select fill (in building/structural areas), general fill (in non-building/structural areas), or bedding material in accordance with public works specifications for the utility to be supported. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1(H):1(V) projection from foundations without engineering review of shoring requirements and geotechnical observation during construction.

On-site Stratum 1/2 materials are considered suitable for backfill of utility and pipe trenches in non-building/structural areas from 1 foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed in building/structural areas, the backfill should satisfy the engineered select fill requirements discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

Earthwork Construction Considerations

Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/ precondition survey should be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines should be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 100 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer (or others under their direction). If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the opportunity to maintain the Geotechnical Engineer’s evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

Footings

Principal column loads for the proposed structures may be supported on isolated (spread) and/or continuous (strip) footings bearing on Stratum 3 limestone.

Footings should bear on compacted select fill, Stratum 2 soils, or Stratum 3 limestone, but not a combination of soils and Stratum 3 limestone within the building. If footings are to bear on soils and the Stratum 3 limestone is encountered during site preparation, the materials should be over-excavated as necessary to provide at least 12 inches of select fill under all footings.

Footing Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1,2]	2,500 psf for select fill or Stratum 2 soils 4,000 psf for Stratum 3 limestone
Required Bearing Stratum	Select fill/Stratum 2 soils or Stratum 3 Limestone
Minimum Foundation Dimensions [3]	Per IBC 1809.7
Ultimate Passive Resistance [4]	360 pcf – select fill or Stratum 2 soils 750 pcf – Stratum 3 limestone
Ultimate Sliding Resistance [5]	0.35 coefficient of friction – select fill or Stratum 2 soils 0.6 coefficient of friction – Stratum 3 limestone
Minimum Embedment Below Finished Grade [6]	18 inches; can be reduced to 12 inches in Stratum 3 limestone
Estimated Total Settlement from Structural Loads [2,7,8]	½ to ¾ inch
Estimated Differential Settlement [2,7,8]	About ½ to ¾ of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume that exterior grades are no steeper than 20% within 10 feet of structure.

2. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated.
3. Most footings are typically rectangular or square in shape. However, circular augered footings bearing on top of Stratum 3 bedrock may also be considered.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face. Assumes no hydrostatic pressure. Passive resistance should be neglected in the first 12 inches below finished grades. Ultimate values should be reduced by an appropriate factor of safety to compute allowable values.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Ultimate values should be reduced by an appropriate factor of safety to compute allowable values. For **select fill** and Stratum 2 soils, we recommend the allowable sliding resistance be limited to **500 psf**. For Stratum 3 limestone, we recommend the allowable sliding resistance be limited to **1,000 psf**.
6. Embedment necessary to minimize the effects of seasonal water content variations and potential future disturbance around the perimeter. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure. **For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure.**
7. The estimated post-construction settlement of the shallow footings is assuming proper construction practices are followed. The settlement response of the footings will be more dependent upon the quality of construction than upon the response of the subgrade to the foundation loads.
8. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet. Differential settlements may result from variances in subsurface conditions, loading conditions, and construction procedures.

Footing Design Parameters – Overturning

Shallow foundations subjected to overturning loads should be proportioned such that the resultant eccentricity is maintained in the center-third of the foundation (e.g., $e < b/6$, where b is the foundation width). This requirement is intended to keep the entire foundation area in compression during the extreme lateral/overturning load event. Foundation oversizing may be required to satisfy this condition.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils with consideration to the IBC basic load combinations.

Item	Description
Foundation Unit Weight	As per Structural Engineer
Soil Total Unit Weight[1]	120 pcf
Soil weight included in uplift resistance	Soil included within the prism extending up from the top perimeter of the footing at an angle of 20 degrees from vertical to ground surface

1. The nominal values should be reduced by an appropriate factor of safety to compute allowable values. Soil weight should be ignored in potential zones of disturbance and in areas where erosion control measures are not used, or soil might otherwise be removed.

Shallow Foundation Construction Considerations

Rock-trenching or saw-cutting equipment will likely be required for footing foundation excavations in Stratum 3 bedrock. Footings/Grade beams should be neat excavated, if possible. If neat excavation is not possible, the foundation should be properly formed. If a toothed bucket is used, excavation with this bucket should be stopped approximately 6 inches above final grade of the footing and the footing excavation be completed with a smooth-mouthed bucket or by hand labor. As noted in **Earthwork**, the footing excavations should be evaluated under the observation of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

Deep Foundations

Drilled Pier Design Parameters

Based upon the subsurface conditions observed we recommend that column loads for the structure may be supported on drilled piers bearing into the Stratum 3 Limestone. Bearing pressures of piers founded in rock are dependent upon the secondary structure of the rock, as well as the compressive strength. Although these secondary features are considered in our recommendations, a pier should not be terminated on a clay layer, void, or a severely weathered zone within the Stratum 3 limestone. While drilling, the driller and field technician should be continuously monitoring for these softer layers. At locations where the design embedment results in the pier terminating on one of these

secondary features, the pier should be extended deeper to bear at least one foot below the feature into competent limestone. Side friction may be counted above and below (but not within) these secondary features.

Due to the subsurface conditions previously mentioned, along with planned cuts and fills, the total pier lengths could vary across the structure, therefore, appropriate base bid depths should be determined for the project. The contract documents should include unit rates for additional drilled pier footage at various pier diameters. In addition, the construction budget should include overages due to the likelihood of additional costs associated with extending many of the drilled piers to greater depths.

Rock design parameters are provided below in the **Drilled Pier Design Summary** table for the design of drilled pier foundations.

Drilled Pier Design Summary [1]

Item	Design Parameter
Bearing Stratum	Stratum 3 Limestone[2]
Minimum Embedment into Bearing Stratum[2]	4 feet or two pier diameters
Minimum Pier Length[3]	5 feet (concreted length)
Minimum Pier Shaft Diameter	18 inches
Minimum Pier Spacing[4]	2 diameters center-to-center
Allowable End Bearing Pressure[5]	Stratum 3: 30,000 psf
Allowable Side Friction[6]	3,000 psf for portions of the pier embedded deeper than 4 feet
Approximate Total Settlement[7,8]	¾-inch
Estimated Differential Settlement[7,8]	½ to ¾ of total

1. Design values are dependent upon the method of installation and quality control parameters.
2. See Subsurface Profile in **Geotechnical Characterization** for more details on stratigraphy.
3. Due to the potential for encountering the limestone bearing stratum at or near the ground surface (particularly in cut areas), we recommend that the total length of piers be no less than the design pier penetration or 5 feet, whichever is greater (even if the scheduled design penetration for the foundation is less than 5 feet). The total pier length refers to the total concreted and reinforced length of the pier, not the total drilled depth of the pier excavation.

4. Drilled piers into Stratum 3 should have a minimum (center-to-center) spacing of two diameters. Closer spacing may require a reduction in axial load capacity. Axial capacity reduction can be determined by comparing the allowable axial capacity determined from the sum of individual piers in a group versus the capacity calculated using the perimeter and base of the pier group acting as a unit. The lesser of the two capacities should be used in design.
5. End bearing may only be used for piers which penetrate at least 4 feet into Stratum 3 Limestone.
6. Applicable for compressive and tensile loading only. The effective weight of the shaft can be added to uplift load resistance to the extent permitted by IBC. Side friction should be neglected in the upper 4 feet of the Stratum 3 Limestone. Permanently cased pier sections, if any, may not be accounted towards the side friction capacity.
7. Provided proper construction practices are followed.
8. Will result from variances in the subsurface conditions, loading conditions, and construction procedures, such as cleanliness of the bearing area or flowing water in the pier hole.

Note, significant clay layers (6 inches in thickness or greater) should not be included in determining the required pier embedment into the rock. For example, if a one-foot-thick clay layer is observed within the rock for a pier with a design embedment of 8 feet, the embedment into limestone should be extended to 9 feet or deeper to account for the loss of side friction. Side friction capacity may be accumulated in increments along the pier sidewalls. It does not have to be a continual zone of limestone without clay. At locations where the design embedment results in the pier terminating on a clay layer, the pier should be extended to bear upon limestone.

Drilled Pier/Shaft Lateral Loading

The following table lists input values for use in LPile analyses. Modern versions of LPile provide estimated default values of k_h and E_{50} based on strength and are recommended for the project. Since deflection or a service limit criterion will most likely control lateral capacity design, no safety/resistance factor is included with the parameters.

Stratigraphy[1]		LPile Soil Model[2]	S_u (psf)[3]	ϕ[3]	γ' (pcf)[3]	Unconfined Compressive Strength (psi)
Stratum	Material					
2	Residual Soils (Fine Grained)	Stiff Clay w/o Free Water	1,500	---	120	---

Stratigraphy[1]		LPile Soil Model[2]	S_u (psf)[3]	ϕ[3]	γ' (pcf)[3]	Unconfined Compressive Strength (psi)
Stratum	Material					
2	Residual Soils (Coarse Grained)	Sand	-	32	120	-
3	Limestone	Strong Rock (Vuggy Limestone)	---	---	135	2,500

1. See Subsurface Profile in **Geotechnical Characterization** for more details on Stratigraphy.
2. LPile's default values for ε_{50} and k should be used.
3. Definition of Terms:
   S_u: Undrained shear strength
   ϕ: Internal friction angle
   γ': Effective unit weight

Minimum Pier Length Considerations in Shallow Limestone Areas

Due to the potential for encountering the limestone bearing stratum at or near the ground surface (particularly in cut areas), we recommend that the total *length* of piers be no less than the design pier penetration or 5 feet, whichever is greater (even if the scheduled design penetration for the foundation is less than 5 feet). The total pier length refers to the total concreted and reinforced length of the pier, not the total drilled depth of the pier excavation. One scenario where this may be encountered are at areas where the bearing stratum is encountered above the top of pier elevation. At these locations, the pier excavation should be extended to a depth such that the pier length (concreted and reinforced length) meets both the minimum design penetration requirements and the 5-foot minimum pier length described above. For example, if a foundation with a top of pier elevation 1.5 feet below the drilling surface and a scheduled design penetration of 4 feet, is constructed in an area where the bearing stratum is encountered 6 inches below the drilling surface, the pier excavation should extend to a minimum depth of 6.5 feet below the drilling surface such that the pier can achieve both the minimum design penetration requirements (e.g., 4 feet) and the minimum concreted and reinforced length (e.g., 5 feet) recommendations.

We recommend that the General Contractor provide elevation information to both the pier drilling subcontractor and concrete subcontractors about the depth to the top of pier (as measured from the drilling surface) so the subcontractors can determine which pier foundation excavations are affected by the above described conditions and need to be deepened. This information should be determined and communicated prior to the start of drilling.

Grade Beams between Drilled Piers

Grade beams spanning between drilled piers may be cast at-grade provided the subgrade in the beam areas is prepared as outlined in **Subgrade Preparation** in **Earthwork**. Beams should be designed to span across the drilled pier foundations without subgrade support, due to stress/strain incompatibility between different bearing materials at varying depths (e.g., fill materials).

We recommend that fat clay soils (LL≥50;PI>30) be utilized for backfill adjacent to grade beams at the exterior surface of the structure (to reduce potential infiltration of surface water into the subgrade areas). The exterior backfill should be compacted as outlined in **Earthwork**. On the interior sides of the perimeter grade beams, backfill should consist of properly compacted select fill or flowable fill (TxDOT Item 401), not sand or gravel. Compaction of select fill on the interior sides of beams should be performed by the Earthwork Contractor's personnel and equipment, not by concrete or utility contractors inexperienced with proper soil placements and compaction.

Drilled Pier Construction Considerations

The drilling contractor should be experienced in the subsurface conditions observed at the site, and the excavations should be performed with equipment capable of providing a clean bearing surface. The drilled straight-shaft foundation system should be installed in general accordance with the procedures presented in "Standard Specification for the Construction of Drilled Piers", ACI Publication No. 336.1-01.

The contractor is generally expected to use conventional "dry" techniques for installation of the drilled shafts. Subsurface water levels are influenced by seasonal and climatic conditions, which result in fluctuations in subsurface water elevations. Additionally, it is common for water to be present after periods of significant rainfall. Thus, casing procedures could be required, if groundwater is present during construction, to reduce the potential for excavation sidewall collapse in the soils above the Stratum 3 limestone.

Drilling equipment should be readily capable of penetrating the Stratum 3 limestone. Drilling equipment with insufficient torque and/or augers/bits/core barrels that are not suited for variable and/or hard rock conditions will likely result in poor production rates.

Care should be taken to not disturb the sides and bottom of the excavation during construction. The drilling contractor should remove all soft and disturbed soils from the base of the drilled pier prior to placing concrete. Concrete should be placed as soon as possible after the foundation excavation is completed, to reduce potential disturbance of the bearing surface. The drilled pier installation process should be performed under the observation of the Geotechnical Engineer. The Geotechnical Engineer should document the pier installation process including soil/rock and groundwater conditions observed, consistency with expected conditions, and details of the installed pier.

Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Construction Considerations

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations, refer to the ACI Design Manual. Joints or cracks should be sealed with a waterproof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing, or other means.

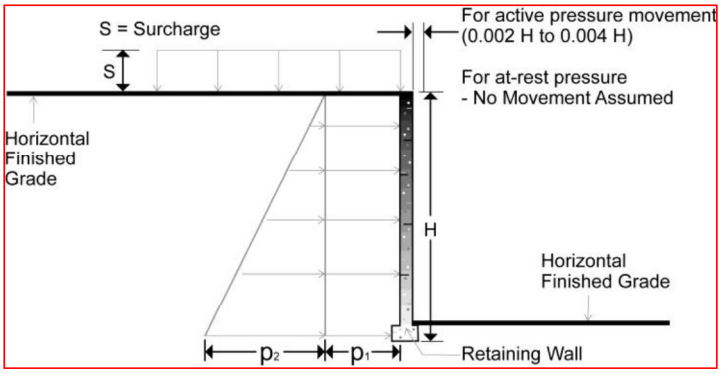
Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Lateral Earth Pressures

Design Parameters

Site retaining walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction, and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated). The following values are intended for walls installed in open cut conditions with backfill (e.g., double formed walls).



Lateral Earth Pressure Design Parameters

Earth Pressure Condition [1]	Coefficient for Backfill Type [2]	Surcharge Pressure [3] p_1 (psf)	Equivalent Fluid Pressures (psf) [2,4]
Active (Ka)	Crushed Limestone Base [5] - 0.28 Clean Gravel [6] - 0.31 Imported Select Fill [7] - 0.33	(0.28)S (0.31)S (0.33)S	(35)H (34)H (40)H
At-Rest (Ko)	Crushed Limestone [5] - 0.44 Clean Gravel [6] - 0.47 Imported Select Fill [7] - 0.50	(0.44)S (0.47)S (0.50)S	(55)H (52)H (60)H

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth

pressure, wall must move horizontally to mobilize resistance. Fat clay or other expansive soils should not be used as backfill behind the wall.
2. Uniform, horizontal backfill, with a maximum unit weight of 125 pcf for crushed limestone base, 110 pcf for granular free-draining gravel soils, and 120 pcf for finer-grained soils such as imported select fill.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. TxDOT Item 247, Type A, Grade 3, or better.
6. Type B or C aggregate per TxDOT Item 556, or similar (gravel meeting ASTM C33, Grade 57 or 67 would also be acceptable).
7. As defined in the **Fill Material Types** subsection of **Earthwork**.

The above values do not include a hydrostatic or ground-level surcharge component. To prevent hydrostatic pressure build-up, retaining walls should incorporate functional drainage (via free-draining aggregate or manufactured drainage mats) within the backfill zone. The effect of surcharge loads, where applicable, should be incorporated into wall pressure diagrams by adding a uniform horizontal pressure component equal to the applicable lateral earth pressure coefficient times the surcharge load, applied to the full height of the wall.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 degrees from vertical for the active case.

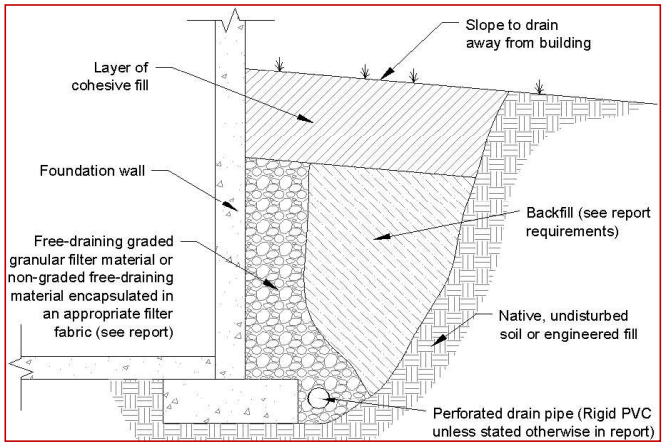
Footings, floor slabs, or other loads bearing on backfill behind walls may have a significant influence on the lateral earth pressure. Placing footings within wall backfill and in the zone of active soil influence on the wall should be avoided unless structural analyses indicate the wall can safely withstand the increased pressure.

All retaining walls should be checked against failure due to overturning, sliding and overall slope stability. Such an analysis can only be performed once the dimensions of the wall and cut/fill scenarios are known. For retaining wall bearing capacity design, we recommend the values provided in **Shallow Foundations** be applied for footings bearing at least 2 feet below final grade.

The lateral earth pressure recommendations given in this section are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block geogrid-reinforced backfill walls (also termed MSE walls).

Subsurface Drainage for Site Retaining Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5% passing the No. 200 sieve, such as No. 57 aggregate. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a prefabricated drainage structure may be used. A prefabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion and is fastened to the wall prior to placing backfill.

Pavements

General Pavement Comments

Minimum recommended pavement thicknesses are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Minimum recommended pavement thicknesses noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Minimum recommended pavement thicknesses are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are

reduced to a level the subgrade can support. It is therefore important to minimize moisture changes in the subgrade to reduce shrink/swell movements. Proper site perimeter drainage should be provided so that infiltration of surface water from unpaved areas surrounding the pavement is minimized.

Pavement Section Thicknesses

The following table provides our opinion of minimum thickness of reinforced PCC pavements.

Portland Cement Reinforced Concrete

Layer	Thickness (inches) [3]		
	Traffic Category A [1]	Traffic Category B [1,2]	Traffic Category E [4]
Reinforced PCC	5.0	6.0	7.0
Crushed Limestone Base	6.0	6.0	6.0
Moisture Conditioned Subgrade	6.0		

1. See **Project Description** for more specifics regarding traffic classifications.
2. All materials should meet the specifications as outlined in **Pavement Materials** below.
3. A thin course of crushed limestone base or clean sand at least 1 to 2 inches thick is recommended under the reinforced concrete in exposed Stratum 3 limestone subgrade areas. Moisture-density testing of the subgrade is not necessary in areas that expose the Stratum 3 limestone subgrade, provided the subgrade is thoroughly proofrolled.
4. We recommend that dumpster pads be constructed of at least 7-inches of reinforced concrete pavementas per Category E or thicker. The concrete pad areas should be designed so that the vehicle wheels of the collection truck are supported on the concrete while the dumpster is being lifted to support the large wheel loading imposed during waste collection. Dumpster areas that are not designed in this manner often experience localized failures due to large wheel loading imposed during waste collection. Reinforced concrete pavements typically result in better performance and less maintenance than flexible pavement systems in these truck areas.

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (e.g., concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Pavement Materials

Presented below are our recommended material requirements for the various pavement sections.

Item	Value
Portland Cement Concrete (PCC)	28-day compressive strength ≥ 4,500 psi
Crushed Limestone Base [1]	TxDOT Item 247, Type A, Grade 1-2 compacted as outlined in **Earthwork**.
Moisture Conditioned Subgrade [2]	As outlined in **Earthwork**.

1. The final lift of paving base should be thoroughly proof-rolled just prior to concrete operations. In addition, the paving base should be thoroughly proofrolled prior to proceeding with placement of subsequent lifts if a rain event occurs or if more than 1 week has elapsed since placement and compaction of the lift of paving base. Particular attention should be paid to areas along curbs, above utility trenches, and adjacent to landscape islands, manholes, and storm drain inlets. Preparation of the base material should extend at least 24 inches behind curbs.
2. Subgrade should not dry out or become saturated prior to pavement construction. The pavement subgrade should be thoroughly proof-rolled as outlined in **Earthwork**. Particular attention should be paid to areas along curbs, above utility trenches, and adjacent to landscape islands, manholes, and storm drain inlets. Preparation of the moisture conditioned subgrade should extend at least 24 inches behind curbs.

Presented below are our recommendations for the construction of the reinforced concrete pavements.

Item	Value
Reinforcing Steel	Category A and B: #3 bars spaced at 18 inches on center in both directions. Category E: #4 bars spaced at 18 inches (or #3 bars spaced at 12 inches) on center in both directions. Rebar should be placed at midpoint of concrete section and supported on chairs prior to concrete placement.
Control (i.e., Contraction) Joint Spacing	In accordance with ACI 330R, control joints should be spaced no greater than 12.5 feet for 5-inch-thick concrete and 15 feet for 6-inch-thick or greater concrete. If sawcut, control joints should be cut within 6 to 12 hours of concrete placement. Sawcut joint should be at least ¼ of the slab thickness.
Expansion (i.e., Isolation) Joint Spacing	ACI 330R indicates that regularly spaced expansion joints may be deleted from concrete pavements, except adjacent to structures, manholes, inlets, light poles, etc. Therefore, the installation of expansion joints is optional and should be evaluated by the design/construction team. Expansion joints, if not sealed and maintained can allow infiltration of surface water into the subgrade.
Dowels at Expansion Joints	¾-inch smooth bars, 18 inches in length, with one end treated to slip, spaced at 12 inches on centers at each joint, and placed level at midpoint of concrete section.

Pavement Drainage

On most projects, rough site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, dry weather may desiccate some areas, rainfall and surface water saturates some areas, heavy traffic from concrete and other delivery vehicles disturbs the subgrade, and many surface irregularities are filled in with loose soils to temporarily improve subgrade conditions. As a result, the pavement subgrade should be carefully evaluated as the time for pavement construction approaches. This is particularly important in and around utility trench cuts. All pavement areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to paving. Thorough proof-rolling of pavement areas should be performed no more than 36 hours prior to surface paving. Proof-rolling should be repeated if the site received rainfall prior to paving. Any problematic areas should be reworked and compacted at that time.

Openings in pavements, such as landscaped islands, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into

the surrounding subgrade soils thereby degrading support of the pavement. Islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils are particular areas of concern. The civil design for the pavements with these conditions should include features to restrict or to collect and discharge excess water from the islands. Examples of features are self-contained planters, edge drains connected to the storm water collection system, longitudinal subdrains, or other suitable outlet, and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic upkeep should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Pavement care consists of both localized (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems (e.g., French drains) surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.

- Construct curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly affect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on

nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Figures

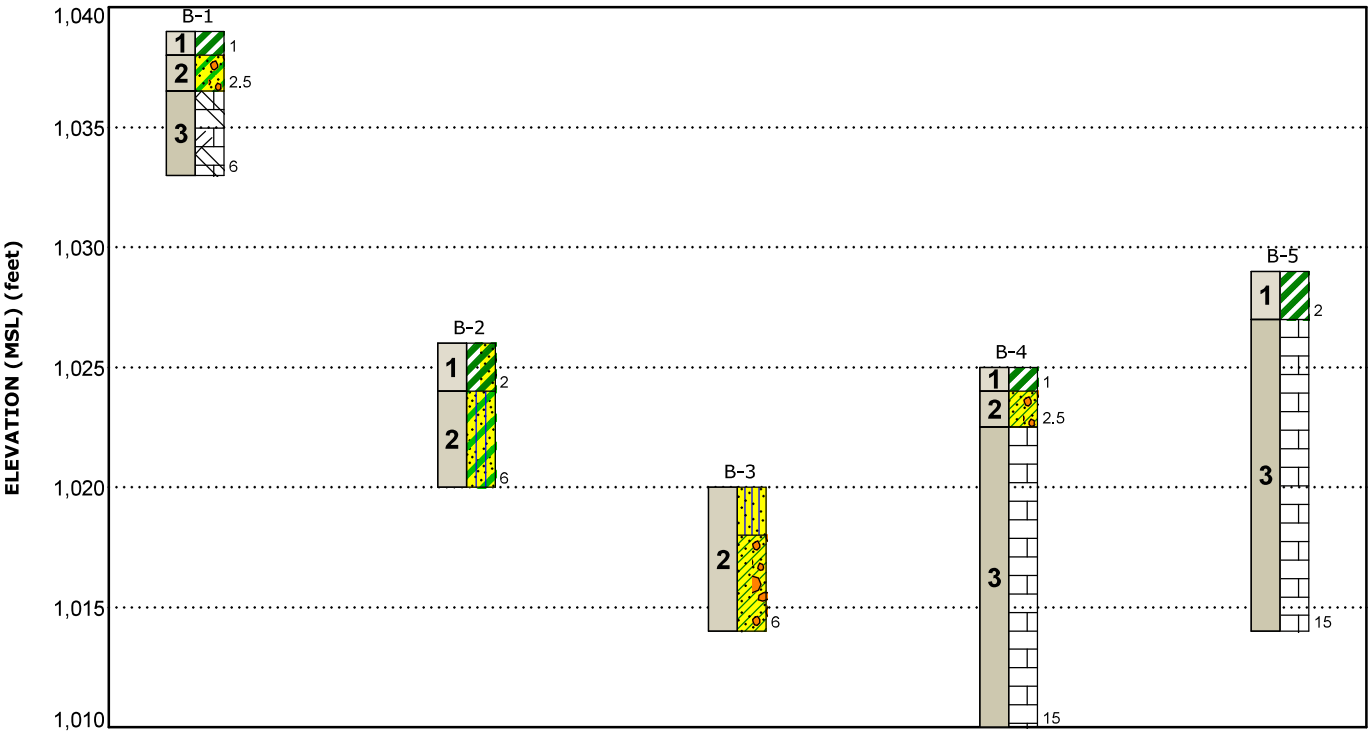
Contents:

GeoModel

Wimberley Fire-Hays - ESD 4
16500 Ranch Road 12 | Wimberley, TX
Terracon Project No. 96255246

Terracon
5307 Industrial Oaks Blvd
Ste 160
Austin, TX

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Native Surficial Soils	Dark brown fat clay (CH) with various amounts of sand and gravel, with organics, hard.
2	Residual Soils	Varies from sandy lean clay (CL) with various amounts of gravel to silty clayey sand (SM) to clayey sand with gravel (SC).
3	Limestone	Pale brown to tan Glen Rose Formation Limestone, moderately to intensely fractured, with clayey seams and layers, slightly vuggy.

Legend	
Fat Clay	Clayey Sand with Gravel
Weathered Limestone	Fat Clay with Sand
Silty Clayey Sand	Silty Sand
Sandy Lean Clay with Gravel	Limestone

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
2	15	Building area
3	6	Parking/driveway area

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. If elevations and a more precise boring layout are desired, we recommend borings be surveyed.

Subsurface Exploration Procedures: Our drilling subcontractor advanced the borings with a truck-mounted rotary drill rig using continuous flight augers. Three samples were obtained in the upper 5 feet of each boring unless bedrock was encountered. Soil sampling was performed using split-barrel sampling procedures. The split-barrel samplers were driven in accordance with the standard test method for standard penetration test (SPT) and split-barrel sampling of soils. Bedrock was sampled with either split-barrel-sampling spoons or cored using NX rock coring equipment. When sufficient bedrock was sampled, the borings were shallowed at the geotechnical engineer's discretion. For safety purposes, all borings were backfilled with auger cuttings after their completion.

Our subcontractor observed and recorded groundwater levels during drilling and sampling. Groundwater was not observed at these times in the boreholes.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following types of tests:

- Moisture Content
- Dry Unit Weight
- Grain Size Distribution
- Atterberg Limits
- Unconfined Compression

The laboratory testing program included examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Rock classification was conducted using locally accepted practices for engineering purposes; petrographic analysis may reveal other rock types. Rock core samples typically provide an improved specimen for this classification. Boring log rock classification was determined using the Description of Rock Properties.

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan (2 pages)

Note: All attachments are one page unless noted above.

Site Location

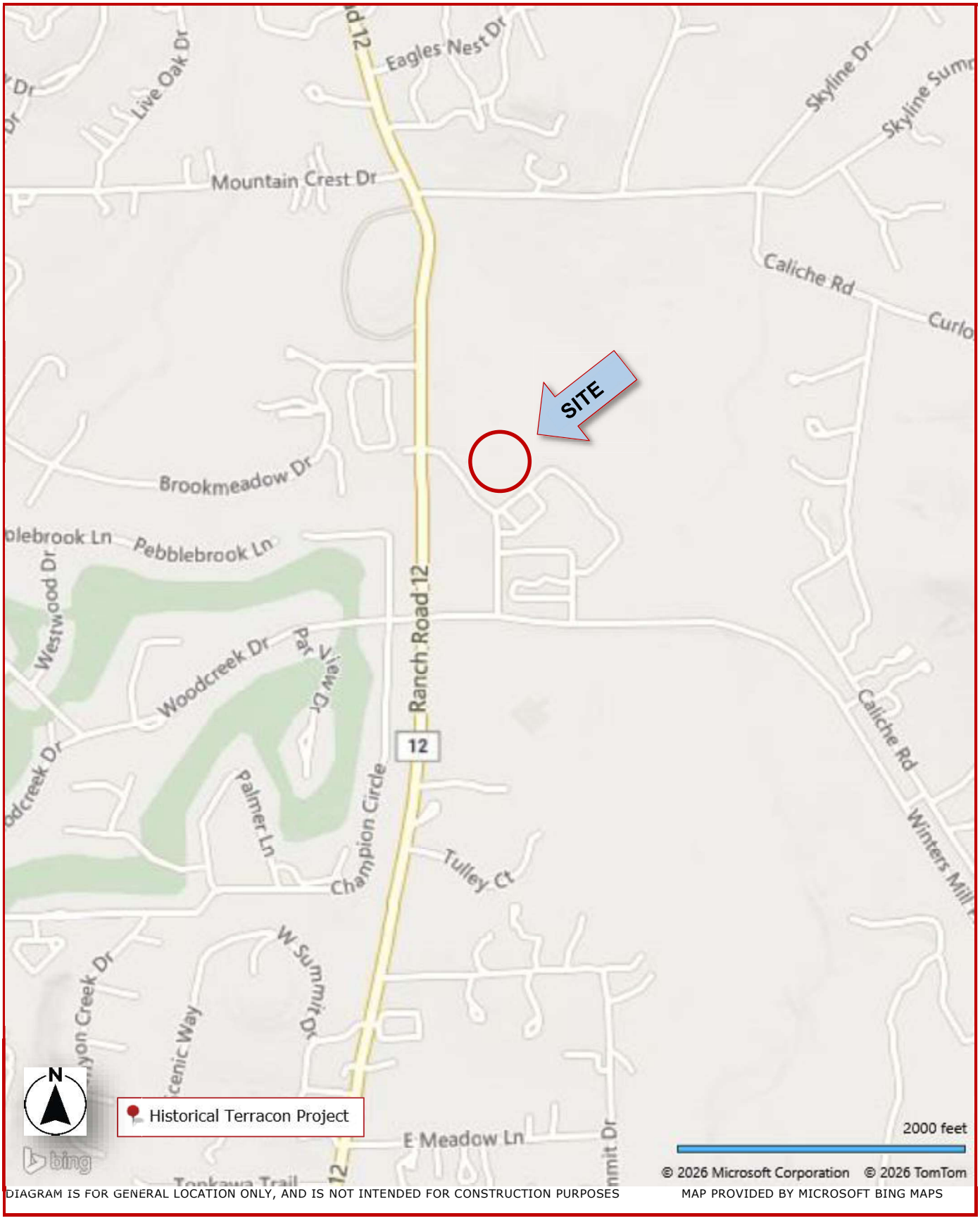


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

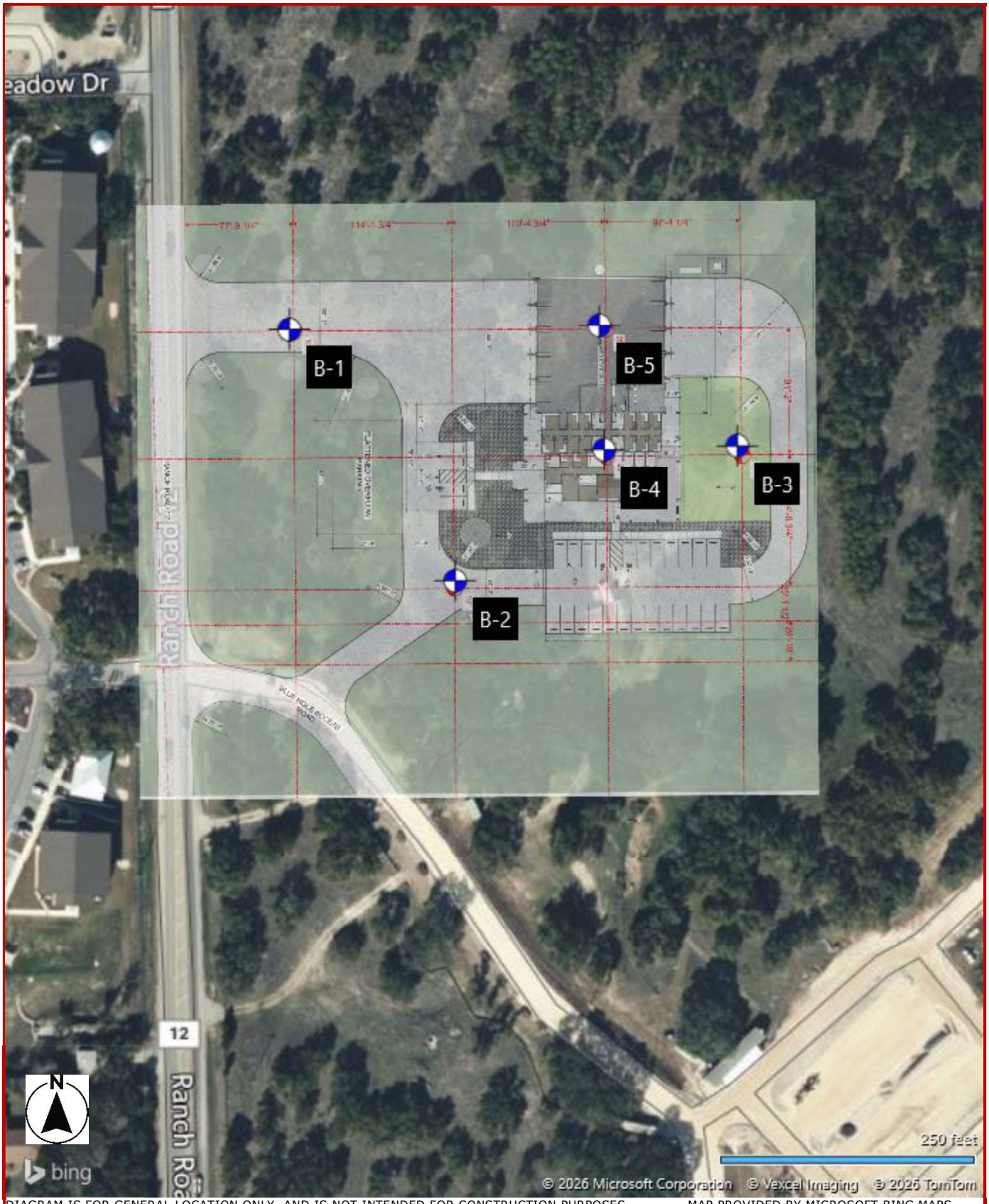


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Boring Logs (B-1 through B-5)
Grain Size Distribution

Note: All attachments are one page unless noted above.

Wimberley Fire-Hays - ESD 4
16500 Ranch Road 12 | Wimberley, TX
Terracon Project No. 96255246

5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 30.0313° Longitude: -98.1010°

Model Layer	Graphic Log	Depth (Ft.)	Elevation: 1039 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Recovery (%) RQD (%)	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		1.0	**FAT CLAY (CH)**, with organics, dark brown, hard — 1038				4.5+ tsf (HP)					14.7			
2		2.5	**CLAYEY SAND WITH GRAVEL (SC)**, pale brown, very dense — 1036.5				21-17-50/5"					6.6			33.3
3		6.0	**WEATHERED LIMESTONE (GLEN ROSE FORMATION)**, pale brown to tan — 1033	5			50/2"					6.2			
			Boring Terminated at 6 Feet												

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from Google Earth Pro.

Water Level Observations
Groundwater not encountered

Drill Rig
B-59

Hammer Type
Automatic

Driller
Core Tech Drilling, Inc.

Notes

Advancement Method
Dry Augered 0 to 6 feet

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Logged by
Core Tech Drilling, Inc.

Boring Started
01-21-2026

Boring Completed
01-21-2026

Wimberley Fire-Hays - ESD 4
16500 Ranch Road 12 | Wimberley, TX
Terracon Project No. 96255246

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Log No. B-2

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 30.0306° Longitude: -98.1005° Depth (Ft.) Elevation: 1026 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Recovery (%) RQD (%)	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		**FAT CLAY WITH SAND (CH)**, trace gravel, dark brown, hard, with organics 2.0 1024				4.5+ tsf (HP)					16.3			
2		**SILTY CLAYEY SAND (SC-SM)**, trace gravel, pale brown to tan, very dense				50/3"					4.4			
			5			29-50/5"					6.3		24-20-4	40.7
		6.0 1020 ***Boring Terminated at 6 Feet***												

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from Google Earth Pro.

Water Level Observations
Groundwater not encountered

Drill Rig
B-59

Hammer Type
Automatic

Driller
Core Tech Drilling, Inc.

Notes

Advancement Method
Dry Augered 0 to 6 feet

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Logged by
Core Tech Drilling, Inc.

Boring Started
01-21-2026

Boring Completed
01-21-2026

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 30.0310° Longitude: -98.0996°

Depth (Ft.) Elevation: 1020 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Recovery (%) RQD (%)	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
		0			18-37-41 N=78					3.7		19-17-2	44.5
		2.0 1018											
2					18-15-50/5"					5.6			59.6
		5			50/5"					6.4			
		6.0 1014											
		Boring Terminated at 6 Feet											

SILTY SAND (SM), trace gravel, pale brown, very dense

SANDY LEAN CLAY WITH GRAVEL (CL), pale brown, hard, with limestone seams and layers

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from Google Earth Pro.

Water Level Observations
Groundwater not encountered

Drill Rig
B-59

Hammer Type
Automatic

Driller
Core Tech Drilling, Inc.

Notes

Advancement Method
Dry Augered 0 to 6 feet

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Logged by
Core Tech Drilling, Inc.

Boring Started
01-21-2026

Boring Completed
01-21-2026

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Log No. B-4

Location: See Exploration Plan

Latitude: 30.0310° Longitude: -98.1000°

Depth (Ft.) Elevation: 1025 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Recovery (%) RQD (%)	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0			4.5+ tsf (HP)					5.7			
1.0	**FAT CLAY (CH)**, with organics, dark brown, hard	1024											
2					50/3"					4.5			
2.5	**SANDY LEAN CLAY WITH GRAVEL (CL)**, pale brown, hard, with limestone seams and layers	1022.5											
3		5				83/0							
	LIMESTONE (GLEN ROSE FORMATION), pale brown to tan, highly to intensely fractured, with clayey seams and layers, slightly vuggy					25/0							
		10											
	with vertical fractures at about 11 feet					88/27	UC	143.22		1.6	119		
	with vertical fractures at about 14 feet												
15.0		1010											
	Boring Terminated at 15 Feet	15											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from Google Earth Pro.

Water Level Observations
Groundwater not encountered

Drill Rig
B-59

Hammer Type
Automatic

Driller
Core Tech Drilling, Inc.

Logged by
Core Tech Drilling, Inc.

Boring Started
01-21-2026

Boring Completed
01-21-2026

Notes

Advancement Method
Dry Augered 0 to 4 feet; Wet Rotary Core 4 to 15 feet

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Log No. B-5

Location: See Exploration Plan

Latitude: 30.0313° Longitude: -98.1001°

Depth (Ft.) Elevation: 1029 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Field Test Results	Recovery (%) RQD (%)	Strength Test: Test Type	Strength Test: Compressive Strength (tsf)	Strength Test: Strain (%)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits: LL-PL-PI	Percent Fines
1		0			4.5+ tsf (HP)					32.2			
		2.0 **FAT CLAY (CH)**, with organics, dark brown, hard 1027											
3		5 **LIMESTONE (GLEN ROSE FORMATION)**, pale brown to tan, moderately fractured, with clayey seams and layers, slightly vuggy				39/31	UC	460.70		0.5	161		
						72/62							
		10				90/67	UC	271.58		0.7	140		
		15.0 1014											
		Boring Terminated at 15 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation Reference: Elevations were interpolated from Google Earth Pro.

Water Level Observations
Groundwater not encountered

Drill Rig
B-59

Hammer Type
Automatic

Driller
Core Tech Drilling, Inc.

Notes

Advancement Method
Dry Augered 0 to 2 feet; Wet Rotary Core 2 to 15 feet

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Logged by
Core Tech Drilling, Inc.

Boring Started
01-21-2026

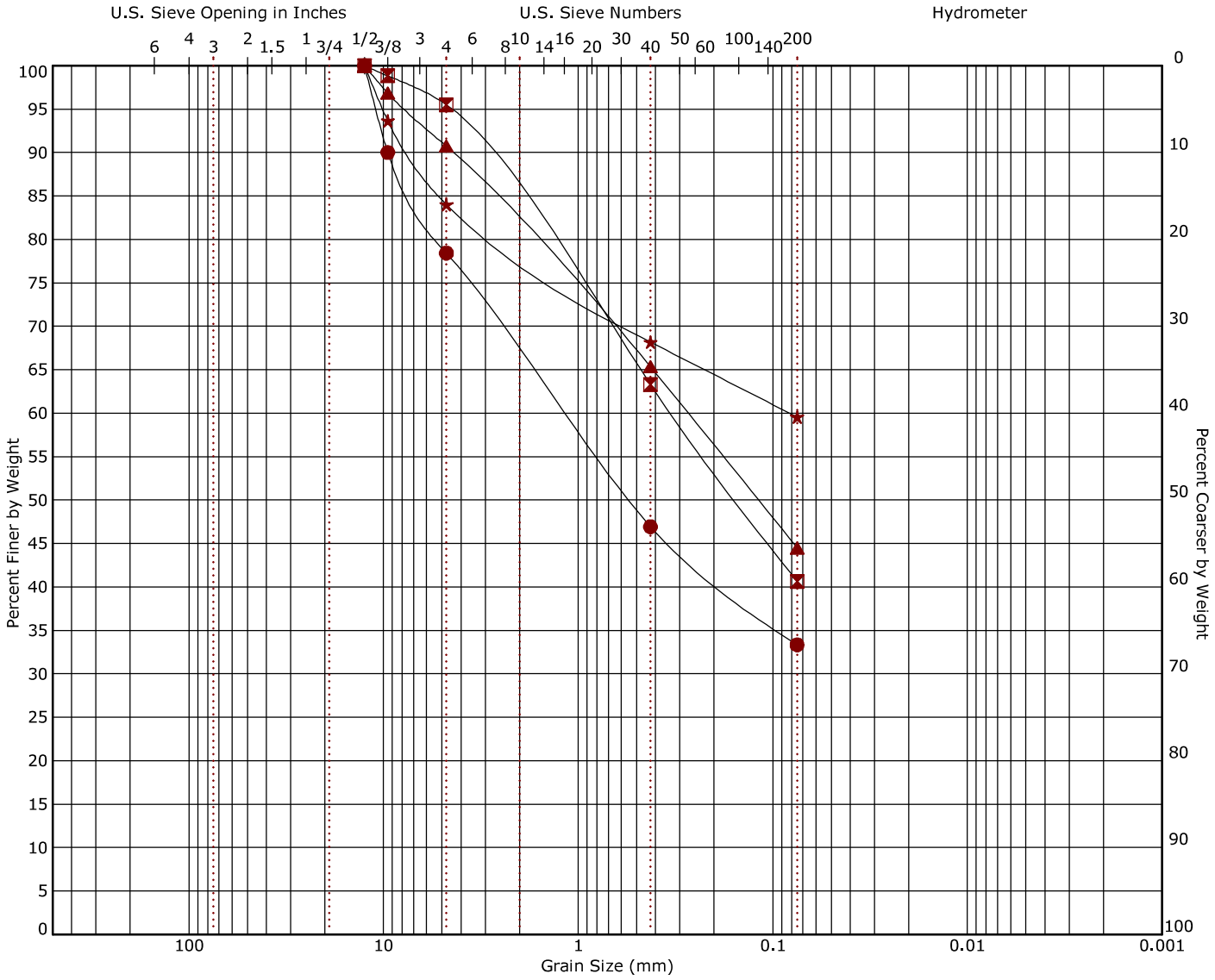
Boring Completed
01-21-2026

Wimberley Fire-Hays - ESD 4
16500 Ranch Road 12 | Wimberley, TX
Terracon Project No. 96255246

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Grain Size Distribution

ASTM D422 / ASTM C136 / AASHTO T27



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Boring ID		Depth (Ft)	Description	USCS	LL	PL	PI	Cc	Cu
●	B-1	2 - 3.4							
⊠	B-2	4 - 4.9	SILTY, CLAYEY SAND	SC-SM	24	20	4		
▲	B-3	0 - 1.5	SILTY SAND	SM	19	17	2		
★	B-3	2 - 3.4							

Boring ID		Depth (Ft)	D_{100}	D_{60}	D_{50}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Fines	%Silt	%Clay
●	B-1	2 - 3.4	12.5	1.156	0.537			0.0	21.6	45.1	33.3		
⊠	B-2	4 - 4.9	12.5	0.33	0.153			0.0	4.5	54.9	40.7		
▲	B-3	0 - 1.5	12.5	0.272	0.119			0.0	9.3	46.2	44.5		
★	B-3	2 - 3.4	12.5	0.082				0.0	16.0	24.5	59.6		

Supporting Information

Contents:

General Notes
Unified Soil Classification System
Description of Rock Properties

Note: All attachments are one page unless noted above.

Wimberley Fire-Hays - ESD 4
16500 Ranch Road 12 | Wimberley, TX
Terracon Project No. 96255246

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

General Notes

Sampling



Water Level



Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

Field Tests

N	Standard Penetration Test Resistance (Blows/Ft.)
(HP)	Hand Penetrometer
(T)	Torvane
(DCP)	Dynamic Cone Penetrometer
UC	Unconfined Compressive Strength
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location And Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils
(More than 50% retained on No. 200 sieve.)
Density determined by Standard Penetration Resistance

Consistency of Fine-Grained Soils
(50% or more passing the No. 200 sieve.)
Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance

Relative Density	Standard Penetration or N-Value (Blows/Ft.)	Consistency	Unconfined Compressive Strength Qu (tsf)	Standard Penetration or N-Value (Blows/Ft.)
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	5 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	9 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	16 - 30
		Hard	> 4.00	> 30

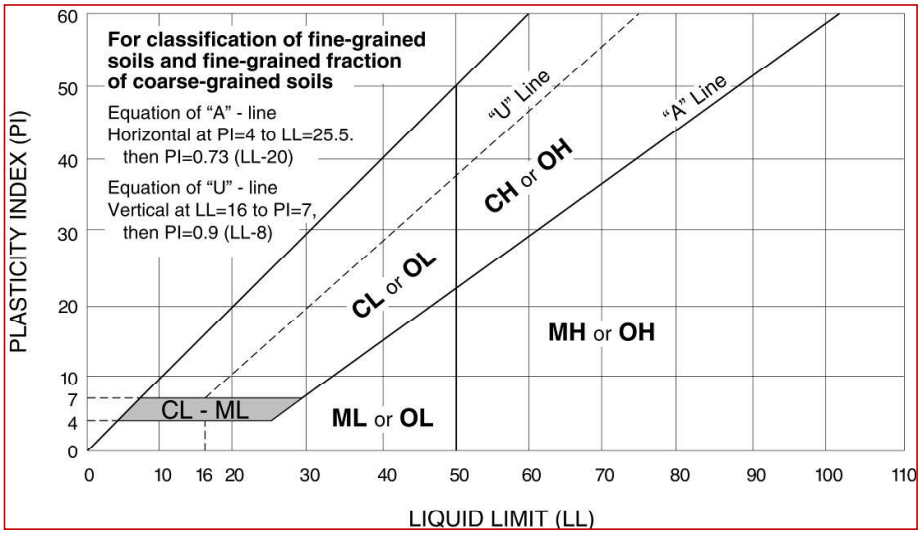
Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu≥4 and 1≤Cc≤3 [E]	GW	Well-graded gravel [F]
			Cu<4 and/or [Cc<1 or Cc>3.0] [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F, G, H]
			Fines classify as CL or CH	GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu≥6 and 1≤Cc≤3 [E]	SW	Well-graded sand [I]
			Cu<6 and/or [Cc<1 or Cc>3.0] [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G, H, I]
			Fines classify as CL or CH	SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OL	Organic clay [K, L, M, N]
					Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K, L, M]
			PI plots below "A" line	MH	Elastic silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.



Rock Classification Notes

WEATHERING	
Term	**Description**
Fresh	Mineral crystals appear bright; show no discoloration. Features show little or no staining on surfaces. Discoloration does not extend into intact rock.
Slightly weathered	Rock generally fresh except along fractures. Some fractures stained and discoloration may extend <0.5 inches into rock.
Moderately weathered	Significant portions of rock are dull and discolored. Rock may be significantly weaker than in fresh state near fractures. Soil zones of limited extent may occur along some fractures.
Highly weathered	Rock dull and discolored throughout. Majority of rock mass is significantly weaker and has decomposed and/or disintegrated; isolated zones of stronger rock and/or soil may occur throughout.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The rock mass or fabric is still evident and largely intact. Isolated zones of stronger rock may occur locally.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi (tsf)**
Extremely strong	Can only be chipped with geological hammer. Rock rings on hammer blows. Cannot be scratched with a sharp pick. Hand specimens require several hard hammer blows to break.	>36,000 (>2,592)
Very strong	Several blows of a geological hammer to fracture. Cannot be scratched with a 20d common steel nail. Can be scratched with a geologist's pick only with difficulty.	15,000-36,000 (1,080-2,592)
Strong	More than one blow of a geological hammer needed to fracture. Can be scratched with a 20d nail or geologist's pick. Gouges or grooves to ¼ inch deep can be excavated by a hard blow of a geologist's pick. Hand specimens can be detached by a moderate blow.	7,500-15,000 (540-1,080)
Medium strong	One blow of geological hammer needed to fracture. Can be distinctly scratched with 20d nail. Can be grooved or gouged 1/16 in. deep by firm pressure with a geologist's pick point. Can be fractured with single firm blow of geological hammer. Can be excavated in small chips (about 1-in. maximum size) by hard blows of the point of a geologist's pick;	3,500-7,500 (252-540)
Weak	Shallow indent by firm blow with geological hammer point. Can be gouged or grooved readily with geologist's pick point. Can be excavated in pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.	700-3,500 (50.4-252)
Very weak	Crumbles under firm blow with geological hammer point. Can be excavated readily with the point of a geologist's pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.	150-700 (10.8-50.4)

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Intensely fractured	< 2.5 inches	**Laminated**	< ½-inch
Highly fractured	2.5 – 8 inches	**Very thin**	½ – 2 inches
Moderately fractured	8 inches to 2 feet	**Thin**	2 inches – 1 foot
Slightly fractured	2 to 6.5 feet	**Medium**	1 – 3 feet
Very slightly fractured	> 6.5 feet	**Thick**	3 – 10 feet
		Massive	> 10 feet

ROCK QUALITY DESIGNATION (RQD) [1]	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

SECTION 00 31 50
INDEPENDENT TESTING AGENCY APPROVALS

PART 1 GENERAL

1.01 SUMMARY

A. The attached Independent Testing Agency approvals are included as an aid ot the building permit-issue authority to indicate substantiation of a particular design feature or element as having been tested for compliance with criteria and requirements contained in the locally prevailing model building code.

B. It shall be recognized that the attached copies of the approved assemblies are a reproduced copy only, and that the formal original versions are available from the issuing Agency.

C. The Independent Testing Agency Approvals bound herein are for the AHJ's and Construction Manager's convenience and information only and are not Contract Documents.

1.02 RESPONSIBILITY

A. Contractor is expected to examine the Independent Testing Agency Approvals and the proposed Contract Documents to become thoroughly familiar with the proper execution of the assemblies to be implemented on this Project, so that the designated assemblies will achieve acceptance by the Authorities Having Jurisdiction.

1.03 PRODUCT SCHEDULE

UL Assembly	Building Component
D925	Floor- Ceiling Assembly
N782	Beam Assembly
P936	Roof- Ceiling Assembly
S735	Beam Assembly
U411	Wall & Partition
U415	Wall & Partition
U417	Wall & Partition
U420	Wall & Partition
U436	Wall & Partition
U438	Wall & Partition
U465	Wall & Partition
U469	Wall & Partition
U904	Wall & Partition
U905	Wall & Partition
X510	Columns
X771	Columns
X772	Columns
C-AJ-0012	Floor-Ceiling Assembly
C-AJ-0055	Floor-Ceiling Assembly
C-AJ-0070	Floor-Ceiling Assembly
C-AJ-0102	Floor-Ceiling Assembly
C-AJ-1184	Floor-Ceiling Assembly
C-AJ-1235	Floor-Ceiling Assembly
C-AJ-1277	Floor-Ceiling Assembly
C-AJ-1291	Floor-Ceiling Assembly
C-AJ-1382	Floor-Ceiling Assembly
C-AJ-1403	Floor-Ceiling Assembly

C-AJ-1406	Floor-Ceiling Assembly
C-AJ-2109	Floor-Ceiling Assembly
C-AJ-2171	Floor-Ceiling Assembly
C-AJ-2210	Floor-Ceiling Assembly
C-AJ-2212	Floor-Ceiling Assembly
C-AJ-3095	Floor-Ceiling Assembly
C-AJ-3185	Floor-Ceiling Assembly
C-AJ-3199	Floor-Ceiling Assembly
C-AJ-4035	Floor-Ceiling Assembly
C-AJ-4054	Floor-Ceiling Assembly
C-AJ-5091	Floor-Ceiling Assembly
C-AJ-5222	Floor-Ceiling Assembly
C-AJ-6006	Floor-Ceiling Assembly
C-AJ-6012	Floor-Ceiling Assembly
C-AJ-6013	Floor-Ceiling Assembly
C-AJ-6017	Floor-Ceiling Assembly
C-AJ-6027	Floor-Ceiling Assembly
C-AJ-7021	Floor-Ceiling Assembly
C-AJ-7040	Floor-Ceiling Assembly
C-AJ-7046	Floor-Ceiling Assembly
C-AJ-7051	Floor-Ceiling Assembly
C-AJ-7067	Floor-Ceiling Assembly
C-AJ-7075	Floor-Ceiling Assembly
C-AJ-7082	Floor-Ceiling Assembly
C-AJ-8042	Floor-Ceiling Assembly
C-AJ-8056	Floor-Ceiling Assembly
C-AJ-8096	Floor-Ceiling Assembly
C-AJ-8101	Floor-Ceiling Assembly
C-AJ-8133	Floor-Ceiling Assembly
C-BJ-4023	Floor-Ceiling Assembly
F-A-1016	Floor-Ceiling Assembly
F-A-1017	Floor-Ceiling Assembly
F-A-2053	Floor-Ceiling Assembly
F-A-2054	Floor-Ceiling Assembly
F-C-1009	Floor-Ceiling Assembly
F-C-1020	Floor-Ceiling Assembly
F-C-3012	Floor-Ceiling Assembly
F-C-3018	Floor-Ceiling Assembly
F-C-3060	Floor-Ceiling Assembly
G204	Floor-Ceiling Assembly
W-J-8007	Wall & Partition
W-L-1054	Wall & Partition
W-L-1152	Wall & Partition
W-L-1207	Wall & Partition
W-L-1249	Wall & Partition

W-L-2078	Wall & Partition
W-L-2128	Wall & Partition
W-L-2167	Wall & Partition
W-L-2170	Wall & Partition
W-L-2185	Wall & Partition
W-L-2259	Wall & Partition
W-L-3065	Wall & Partition
W-L-3112	Wall & Partition
W-L-3179	Wall & Partition
W-L-4025	Wall & Partition
W-L-4030	Wall & Partition
W-L-4034	Wall & Partition
W-L-5029	Wall & Partition
W-L-5171	Wall & Partition
W-L-8007	Wall & Partition
W-L-8014	Wall & Partition

A. UL = Underwriters Laboratories, Inc.

END OF SECTION 00 31 50

SECTION 00 43 23
ALTERNATES FORM

END OF SECTION 00 43 23

SECTION 00 72 13
GENERAL CONDITIONS

PART 1 GENERAL CONDITIONS OF THE CONTRACT

1.01 GENERAL CONDITIONS OF THE CONTRACT

A. The General Conditions of the Contract for this Project are stated in the following form, which is not incorporated herein.
   1. AIA Document, A201, 2017 Edition, GENERAL CONDITIONS OF THE CONTRACT OF THE CONTRACT FOR CONSTRUCTION

1.02 SUPPLEMENTARY CONDITIONS

A. Certain articles of the General Conditions are revised by requirements of the Supplementary Conditions; see Section 00 73 00. Such revisions or replacements shall take precedence over the General Conditions. All provisions not specifically modified by Supplementary Conditions shall remain in effect.

END OF SECTION 00 72 13

SECTION 00 73 00
SUPPLEMENTARY CONDITIONS

ARTICLE 1 GENERAL

The following supplements modify the "General Conditions of the Contract for Construction", AIA Document A201, Seventeenth Edition, 2017. The portions of the General conditions not modified, supplemented or deleted by these Supplementary conditions shall remain in effect. As appropriate, for purposes of this Request for Proposal, the term "Bid" shall mean "Proposal" and the term "Bidder" shall mean "Offeror" wherever they appear in the Construction Documents.

1.1

1.1.1 **BASIC DEFINITIONS**

1.1.2 **THE WORK**

Add the following sentence at the end of this paragraph:

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

Add Subparagraphs 1.1.3 and 1.1.4 as follows:

1.1.3 **NAMES OF PARTIES**

The following definitions apply to parties named in the Contract Documents:

a. Owner: Hays County ESD #4
P.O. Box 1312
111 Green Acres Dr.
Wimberley, Texas 78676
Phone: (512) 847-3536

b. Architect: Martinez Architects, LP
900 Rockmead, Suite 250
Houston, TX 77339
Phone: (281) 800-1023

1.1.4 **BIDDING DOCUMENTS**

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

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENT

Add subparagraph 1.2.1 as follows:

1.2.1 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities.

a. The Agreement.
b. Addenda, with those of later date having precedence over those of earlier date.
c. The Supplementary Conditions.
d. The General Conditions of the Contract for Construction.
e. Drawings and Specifications.

In the case of an inconsistency between the Drawings and Specifications or within either Document not clarified by an Addendum, the better quality or greater quantity of Work shall be included in the Bid. Clarifications of the inconsistency will be accomplished with the Contractor after award of Contract and, if necessary, an appropriate reduction in the Contract will be accomplished by Change Order.

1.2.2 Add Paragraph 1.3 as follows:

1.3 MISCELLANEOUS OTHER DEFINITIONS

1.3.1 **ABBREVIATIONS**

N.I.C. Not in Contract. Indicating work not required to be done by this Contractor under this agreement.

ACI AMERICAN CONCRETE INSTITUTE

ADA AMERICANS WITH DISABILITIES ACT OF 1990

ADAAG AMERICANS DISABILITIES ACT ACCESSIBILITY GUIDELINES FOR BUILDINGS & FACILITIES

AIA AMERICAN INSTITUTE OF ARCHITECTS

AIEE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

AISC AMERICAN INSTITUTE OF STEEL CONSTRUCTION

AISI AMERICAN IRON AND STEEL INSTITUTE

ANSI AMERICAN NATIONAL STANDARDS INSTITUTE

ASA AMERICAN STANDARDS ASSOCIATION

ASTM AMERICAN SOCIETY FOR TESTING MATERIALS

AWSC AMERICAN WELDING SOCIETY CODE

FS FEDERAL SPECIFICATION

NBS NATIONAL BUREAU OF STANDARDS

NEC NATIONAL ELECTRIC CODE

SPR SIMPLIFIED PRACTICE RECOMMENDATION

TAS TEXAS ACCESSIBILITY STANDARDS

UL UNDERWRITERS LABORATORIES, INC.

1.3.2 **ADDENDA, ADDENDUM**

Documents issued by the Architect prior to execution of the Owner Contractor Agreement that modify or clarify the Bidding Documents. All addenda become a part of the Contract Documents.

1.3.3 **ALTERNATE BID(S)**

A separate amount which, if accepted by the Owner, will be added to or deducted from the Base Bid. If accepted, the work that corresponds to the alternate bid will become part of the agreement between Owner and Contractor. Alternate bids shall remain valid for the same period of time as the Base Bid after receipt of bids, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

1.3.4 **APPROVED, APPROVED EQUIVALENT, APPROVED EQUAL, OR EQUAL**

The terms Approved, Approved Equivalent, Approved Equal, and Or Equal, relate to the substitution of products or systems approved in writing by the Architect. Refer to Paragraph 3.19, Substitution of Products and systems, for procedures which must be followed after award of contract. The substitution procedure process to be followed prior to receipt of bids is described in the Instructions to Bidders.

1.3.5 **BASE BID**

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

1.3.6 **CONTRACT TIME**

The period of time including Anticipated Weather Days, which is established in the Contract Documents for Substantial Completion of the Work. This period of time is subject to authorized

adjustments for Unanticipated Weather Days and other Calendar Day extensions of time as enumerated in the Contract Documents.

1.3.7 **DATE OF AGREEMENT**

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

1.3.8 **DATE OF COMMENCEMENT OF THE WORK**

The date indicated in the written Notice to Proceed delivered to the Contractor.

1.3.9 **DATE OF FINAL COMPLETION**

The end of construction. See AIA Document A201, paragraph 9.10

1.3.10 **DAY**

The following days are referenced in the documents:

a. Calendar Days: The days of the Gregorian Calendar. The Contract Time is established in Calendar Days. Extensions of time granted for Regular Work Days lost, if any, will be converted to Calendar Days.
b. Holidays: The days officially recognized by the construction industry in this area a holiday; normally limited to the observance days of New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and the day after, and Christmas Day.
c. Regular Work Days: All calendar days except holidays, Saturdays, and Sundays. Requests for extensions of time shall be requested on the basis of Regular Work Days, and those days, if approved, will be converted to calendar days by multiplying by a factor of one and four-tenths (1.4).
d. Anticipated Weather Days: An allowance of Regular Work Days established as probable days lost due to weather delays; said allowance to be included in the Contractor's proposed Completion Time on his Bid Form.
e. Weather Days: Regular Work Days when rain, flooding, snow, unusually high winds, excessively wet grounds, or similar circumstances prevent progress on major portions of the Work. The Contractor will be entitled to an extension of the Contract Time for the net additional time, if any, which result from deducting the amount of Anticipated Weather Days from the total amount of Weather Days.
f. Net Weather Days: The difference in working days between Anticipated Weather Days and Weather Days.

1.3.11 **NOTICE TO PROCEED**

1.3.12 A notice that may be given by the Architect on behalf of the Owner to the Contractor that directs the Contractor to start the Work. It may also establish the Date of Commencement of the Work.

1.3.13 **PROVIDE**

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

1.3.14 **PUNCH LIST**

2.1 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Delete Subparagraph 2.2.5 in its entirety and replace it with the following:

2.1.1 The Contractor will be furnished electronic copies of Drawings and Project Manuals. Hardcopies will be furnished at the cost of reproduction, postage, and handling.

Add Paragraph 2.2 as following:

2.2 OWNER'S LACK OF LIABILITY TO THIRD PARTY

2.2.1 The Owner shall have the right to occupy or use without prejudice to the right of either party, any completed or largely completed portions of the project, notwithstanding the time completing the entire work or such portions may not have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents.

2.2.2 Add Paragraph 2.3 as follows:

2.3 OWNER'S RIGHT TO OCCUPY THE PROJECT

2.3.1 The Owner shall have the right to occupy or use without prejudice to the right of either party, any completed or largely completed portions of the project, notwithstanding the time completing the entire work or such portions may not have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents.

2.3.2 If such prior use delays the completion of the Project, the Contractor shall be entitled to extension of time, claim for which shall be made in writing with supporting data attached.

2.3.3 Refer to Article 11, Insurance and Bonds, regarding property insurance requirements in the event of such occupancy.

ARTICLE 3 CONTRACTOR

3.1 GENERAL

Add Subparagraph 3.1.4 as follows:

3.1.1 The Contractor must be fully qualified under any state or local licensing laws for Contractors in effect at the time and at the location of the work. The Contractor is responsible for determining all his subcontractors and prospective subcontractors are duly licensed in accordance with the law.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

Add Subparagraphs 3.2.1, 3.2.2, 3.2.3 and 3.2.4 as follows:

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

3.2.2

3.2.3 If, in the opinion of the Architect, the Contractor does not make a reasonable effort to comply with the above requirements of the Contract Documents and this causes the Architect or his Consultants to expend an unreasonable amount of time in the discharge of duties imposed on him by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's additional services made necessary by such failure. The Architect will give the Contractor prior notice of intent to bill for additional services related to Articles 3.2.5, 3.2.6, and 3.12 before additional services are performed.

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

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Add Subparagraph 3.3.1 as follows:

3.3.1 The Contractor is especially cautioned to coordinate the routing of mechanical and electrical items prior to commencing these operations.

3.4 WARRANTY

Add Subparagraphs 3.4.1, 3.4.2 and 3.4.3 as follows:

3.4.1 In the event of failure of a specified product, either during construction or the warranty period, the Contractor shall take appropriate measures with the manufacturer of the product to assure correction or replacement of the defective products.

3.4.2 Refer to General Contractor Guarantee and Subcontractor Guarantee forms included under Section 01 77 00, Construction Contract Close Out which will be required prior to final payment.

3.4.3 Approximately eleven months after Substantial Completion, the Contractor shall accompany the Owner and Architect on an end of the one-year Warranty period re-inspection of the Project. Additional deficiencies observed or reported shall be corrected by the Contractor.

3.5 TAXES

Add Subparagraph 3.5.1 as follows:

3.5.1 In accordance with Section 151.311 of the Texas Tax Code, the Owner is exempt from all sales tax on the purchase of tangible personal property under Section 151.309 of the Texas Tax Code. The Owner will issue certificates of Exemption from sales tax on tangible personal property furnished by the Contractor on this construction project. The Contractor shall issue Certificates of Resale to their subcontractors and suppliers in order to avoid payment of any sales tax on materials incorporated into this project. Failure of the Contractor to issue Certificates of Resale to the subcontractors and suppliers shall make the Contractor responsible for absorbing the tax. Refer to Section 151.311 of the Texas Tax Code for the definition of tangible personal property.

3.6 PERMITS, FEES, AND NOTICES

3.6.1 At Subparagraph 3.6.1, add the following subparagraphs:

a. The Owner shall pay directly to the governing authority the cost of all permanent property utility assessments, tap charges, and similar utility connection charges.
b. The Contractor shall be responsible for obtaining and paying for all City and County Building Permits, Inspection Fees and Plan Checking Fees; temporary utility charges, and water meter charges and any other similar fees assessed by jurisdictional authorities having control over this Project.
c. Fees payable to American Construction Investigations, LTD for document review relative to the Elimination of Architectural Barriers Act shall be paid by the Owner. Architect will submit the documents to American Construction Investigations, LTD for review and approval.

3.7 ALLOWANCES

Delete Paragraph 3.9 in its entirety. Refer to Section 01 21 00, Allowances.

3.8 SUPERINTENDENT

Add Subparagraph 3.8.1 as follows:

3.8.1 The Superintendent shall be satisfactory to the Owner and shall not be changed except with the consent of the Architect, unless the Superintendent leaves the employment of the Contractor. No increase in Contract Time or Contract Sum shall be allowed in the event the Owner or Architects object to any nominated superintendent.

3.8.2 The Superintendent shall remain on the project full time until Final Payment is issued.

3.9 CONTRACTOR'S CONSTRUCTION SCHEDULES

Add Subparagraph 3.9.1 as follows:

3.9.1 The Contractor shall submit to the Architect, with each monthly Application for Payment, a copy of the progress schedule updated to reflect the current status of the project. The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

3.10 DOCUMENTS AND SAMPLES AT THE SITE

Add Subparagraph 3.10.1 as follows:

3.10.1 The Contractor shall post all Addenda on Construction Documents prior to commencing work in the site.

3.11 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

At Subparagraph 3.11.3, add the following subparagraphs:

a. If, in the opinion of the Architect, the Shop Drawings, Product Data, Samples and similar submittals are incomplete, indicate an inadequate understanding of the work covered by the submittals, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the submittals will be returned, unchecked, to the Contractor for correction of these three deficiencies and subsequent resubmittal. Additional service charges as outlined in 3.2.6 may be charged by the Architect in this event.

b. The Architect will take no action on Shop Drawings, Product Data, and Samples that have not first been certified, by stamped, signed notation, as having been checked and approved by the Contractor for use in the Work, or that are not specifically required by the Contract Documents.

At Subparagraph 3.11.4, correct the work “approved” to read “accepted”.

At Subparagraph 3.11., correct “Architect’s approval” to read “Architect’s acceptance”.

At Subparagraph 3.11.6, correct “Architect’s approval” to read “architect’s acceptance” and add the following paragraph:

c. Deviation from the requirements of the Contract Documents indicated on Shop Drawings, Product Data, and Samples, does not constitute the required notification “in writing”.

Add Subparagraphs 3.12.7 and 3.12.8 as follows:

3.11.1 The Contractor shall submit complete Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents to the Architect at least 15 days prior to the date the Contractor needs the reviewed submittals returned. Where colors are to be selected by the Architect, submit all Samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within four weeks of the date of the contract for construction.

3.11.2 The Contractor shall submit the number of copies of Shop Drawings, Product Data, Samples and similar submittals which the Contractor and his subcontractors need for their use plus two additional sets for the Architect and one additional set for each of the Architect’s consultants involved with the particular section of work. Where shop drawings are involved, submit two opaque prints of the shop drawing for the Architect plus one additional opaque print for each of the Architect’s consultants involved with the particular section of work. The shop drawings will be marked by the Architect and/or his consultants and returned to the Contractor for his use, distribution, correction or resubmittal as required. After final review and correction of the submittal, the Contractor shall send two corrected sets to the Architect, and one to the Architect’s consultants involved with the particular section of work.

3.12 CLEAN UP

Add Subparagraph 3.12.1 as follows:

3.12.1 Prior to the Architect’s inspection for Substantial Completion, the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; replace air filters in mechanical equipment; clean roof, gutters, and downspouts; remove obstructions and flush debris from drainage systems; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site.

3.13 INDEMNIFICATION

Delete Subparagraphs 3.13.1 and 3.13.2 in their entirety and replace them with the following:

3.13.1 To the fullest extent permitted by applicable law, Contractor shall and does indemnify, protect, defend and hold harmless the Owner, Architect and their respective officers, directors, trustees, shareholders, employees and agents (collectively the “Indemnitees”) from and against all claims, damages, losses, liens, causes of action, suits, judgments and expenses, including attorney fees, (A) of any nature, kind or description of any person or entity, including any governmental agency or authority, directly or indirectly arising out of, caused by, or resulting from (in whole or in part), (1) the Work performed hereunder, or any part thereof, or (2) any act or omission of Contractor,

any subcontractor, anyone directly or indirectly employed by them, or anyone that they control or exercise control over, including any of the foregoing caused in whole or in part by the negligence of any Indemnitee or (B) brought by or on behalf of any employee of Contractor or any Subcontractor (collectively the "Liabilities").

THE CONTRACTOR'S OBLIGATION TO SO INDEMNIFY OWNER AND THE INDEMNITEES SHALL INCLUDE INDEMNIFICATION FOR ANY OF SUCH MATTERS CAUSED IN WHOLE OR IN PART BY THE CONCURRENT OR JOINT NEGLIGENCE OF OWNER OR ANY INDEMNITEE.

Contractor shall promptly advise Owner in writing of any action, administrative or legal proceeding or investigation as to which this indemnification may apply, and Contractor, at Contractor's expense, shall assume on behalf of Owner (and other indemnitees) and conduct with due diligence and in good faith the defense thereof with counsel satisfactory to Owner; provided however, that Owner shall have right, at its option, to be represented therein by advisory counsel of its own selection and at its own expense. In the event of failure by Contractor to fully perform in accordance with this indemnification paragraph, Owner, at its option, and without relieving Contractor of its obligations hereunder, may so perform, but all costs and expenses so incurred by Owner in that event shall be reimbursed by Contractor to Owner, together with interest on the same from the date any such expense was paid by Owner until reimbursed by Contractor, at the rate of interest provided to be paid on judgments under the laws of the State of Texas. This indemnification shall not be limited to damages, compensation or benefits payable under insurance policies, workers' compensation acts, disability benefits acts or other employees' benefits acts.

3.13.2 It is understood and agreed that Subparagraph 3.18 above is subject to, and expressly limited by, the terms and conditions of TEX. CIV. PRACT. & REM. CODE ANN. 130.001-130.005 (Vernon Supp. 1989), as amended or modified, or any successor statute. Contractor shall not be obligated under Subparagraph 3.18 to indemnify or hold harmless Architect or any agent, servant of employee of Architect from liability or damage that:

a. is caused by or results from:
   (1) defects in plans, designs or specifications prepared, approved or used by the Architect; or
   (2) negligence of the Architect in the rendition or conduct of professional duties called for or arising out of the Contract Documents and the plans, designs or specifications that are a part of the Contract Documents; and
b. arises from:
   (1) personal injury or death;
   (2) property injury; or
   (3) any other expense that arises from personal injury, death or property injury.

3.13.3 It is agreed with respect to any legal limitations, now or hereafter in effect and affecting the validity or enforceability of the indemnification obligation under Paragraph 3.18, such legal limitations are made a part of the indemnification obligation and shall operate to amend the indemnification obligation to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the indemnification obligation shall continue in full force and effect.

Add Paragraphs 3.14, 3.15, 3.16 and 3.2.17 as follows:

3.14 SUBSTITUTIONS OF PRODUCTS AND SYSTEMS, "OR EQUAL" BRANDS

3.14.1 The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and have been approved in an addendum as a substitution prior to the submission of bids. If prior written approval in an addendum has not been obtained, it will be assumed that the Bid is based upon the materials, products, and systems

described in the Bidding Documents and no substitutions will be permitted, except as provided hereinafter.

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

3.14.3 Substitution requests shall be submitted on the forms included herein and in accordance with the process established in Section 01 25 13 - Product Substitutions.

3.15 RECORD DRAWINGS

3.15.1 At the completion of the project, the Contractor shall submit one electronic file (AutoCAD & Adobe Acrobat newest version acceptable to the Owner) containing all of the drawings showing all changes made during bidding and construction and one set of opaque reproducibles printed from this "record set".

3.16 PREVAILING WAGE RATE

3.16.1 No employee used in this construction may be less than a minimum wage rate provided in Article 5159dm Vernon's Civil Statutes, Annotated, revised 1995 and The Texas Minimum Wage Act of 1970. Refer to Document 00 73 43 – Prevailing Wage Rates.

3.17 ANTITRUST VIOLATIONS

3.17.1 To permit the Owner to recover damages suffered in antitrust violations, the Owner-Contractor Agreement shall include the following wording, "Contractor hereby assigns to Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A., Section 1 et. seq. (1973)". The Contractor shall include such provisions in agreements with Sub-Subcontractors and Suppliers.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

4.1 CLAIMS AND DISPUTES

4.1.1 Correct "21 days" to read "90 days".

4.1.2 Correct "21 days" to read "90 days".

4.2 RESOLUTION OF CLAIMS AND DISPUTES

Delete all references to arbitration.

Delete Subparagraph 4.4.6 in its entirety.

4.3 MEDIATION

4.3.1 Delete reference to "as a condition precedent to arbitration".

Delete Subparagraph 4.3.2 in its entirety and replace it with the following:

4.3.2 The parties shall endeavor to resolve their claims by mediation which, unless the parties mutually agree otherwise, shall in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract. Mediation shall proceed in advance of legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order.

4.3.3 Delete Paragraph 4.6 in its entirety and all references to Arbitration.

ARTICLE 5 SUBCONTRACTORS

5.1 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF WORK

Delete Subparagraph 5.1.1 in its entirety and replace it with the following:

5.1.1 As soon as practicable after Award of the Contract, but no later than 10 days prior to the submittal date for the Contractor's first Application for Payment, the Contractor shall furnish the Owner and Architect, in writing, a list of the persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each of the principal portions of the Work. The list shall include the name, address, and telephone and fax numbers, and contact person for each Subcontractor and/or Supplier. The Architect will promptly reply to the Contractor in writing stating whether or not the Owner or Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly shall constitute notice of no reasonable objection. Failure of the Contractor to submit the subject names in a timely manner will delay processing of the Contractor's Application for Payment.

At Subparagraph 5.2.4, add the following sentence:

Prior to such change the Contractor shall notify the Architect of his intent and reasons for such proposed changes.

ARTICLE 7 CHANGES IN THE WORK

Add paragraph 7.1 as follows:

7.1 ALLOWABLE MARKUPS FOR CHANGES IN THE WORK

7.1.1 In Subparagraphs 7.2.2, 7.3.3, and 7.3.6 the allowance for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

a. For the Contractor, for work preformed by the Contractor's own forces, a maximum total markup of 10 percent of the actual cost.
b. For the Contractor for Work performed by the Contractor's Subcontractor(s), 5 percent of the amount due the Subcontractor(s).
c. For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's or Sub-subcontractor's own forces, a maximum markup of 10 percent of the actual cost.
d. For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, 5 percent of the amount due the Sub-subcontractor.
e. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.
f. In order to facilitate checking of quotations for extras or credits, all proposals of Contractors, Subcontractors, and Sub-subcontractors, (except those so minor that their propriety can be seen by inspection), shall be accompanied by complete and detailed work sheets showing itemization of costs including labor, materials, and other costs.

ARTICLE 8 TIME

8.1 DEFINITIONS

Delete subparagraph 8.1.1 in its entirety and replace it with the following:

8.1.1 Unless agreed otherwise, the date inserted on the Agreement form and the Date of Commencement of the Work shall be as follows:

a. The date inserted on the first page of the Agreement form will be the date the Owner formally awards the Contract. As soon as feasible after receipt of Bids, the Architect will present Agreement forms to the Contractor for his review and signature. The Contractor will be allowed a maximum of five (5) days from the date the prepared Agreements are presented to him to: 1) obtain the required bond forms and insurance certificates and, 2) return the executed Agreements and supporting documents to the Architect for transmittal to the Owner for his final review and execution.
b. The Date of Commencement of the Work: Refer to Subparagraph 1.6.8.

8.2 PROGRESS AND COMPLETION

Delete subsection 8.2.1; substitute the following:

8.2.1 Time is of the essence and completion of the Work must be within the time stated in the contract subject to such extensions as may be granted under Section 8.3. The Contractor agrees to commence work no later than ten days after date of issuance of the written Notice to Proceed and to substantially complete the project within the time stated in the contract.The Contract Time is the calendar days from date of written Notice to Proceed stated in the Contract, subject to such extensions as are authorized as stipulated in the Conditions of the Contract including these Supplementary Conditions.

8.3 DELAYS AND EXTENSIONS OF TIME

Delete Subparagraph 8.3.1 in its entirety and replace it with the following:

8.3.1 If the Contractor is delayed at any time in the progress of the work by any act of neglect of the Owner or the Architect, or by an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delays in deliveries, unavoidable casualties, Net Weather Days, or other causes beyond the Contractor's control, or by other causes which Architect determines may justify the delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect and Owner may determine.

Add Subparagraphs 8.3.2, 8.3.3, 8.3.4 and 8.3.5 as follows:

8.3.2 Extensions of time granted for causes described herein will be granted on the basis of 1.4 Calendar Days extension for each Regular Working Day lost, except as modified by the provisions contained herein related to Anticipated Inclement Weather days.

8.3.3 Each Bidder shall include in his proposed Contract Time an allowance of Anticipated Inclement Weather Days in accordance with the following schedule:

Number of Anticipated Inclement Weather Days to be included in Bid Completion Time (These are regular working days).

January – 5	April – 4	July – 4	October – 3
February – 3	May – 5	August – 5	November – 3
March – 2	June – 6	September – 5	December - 4

8.3.4 Weather Days shall be as described in Subparagraph 1.6.11.6. If such situations occur in more than the number of Anticipated Inclement Weather Days included in the Bid Completion Time and if those additional days prevent the Contractor from performing critical portions of the scheduled Work, extensions of time caused by inclement weather may be requested as enumerated hereinafter.

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

8.3.6

Month	Anticipated	Weather Days (Regular)Actual Requested	Net
January	3	8	5
February	4	0	-4
March	4	2	-2
April	2	2	0

May	5	7	2
June	6	10	4
TOTALS	24	29	5

Using this example (and assuming that all requested days were approved), there were 5 Net Weather Days (regular working days) for the first six months of the project and the extension of Contract Time would be 7 calendar days (5 working days x 1.4 = 7 calendar days).

Add paragraph 8.4 as follows:

8.4 LIQUIDATED DAMAGES

The work to be performed under this Contract shall begin upon receipt of the Notice to Proceed, and shall be substantially completed within 365 calendar days, or as stipulated in the Contract Documents, whichever is earlier, or by such dates thereafter as may be established by any written extensions granted under Article 8 of the General Conditions. The parties hereto agree that time is of the essence to this Contract, and that the pecuniary damages that would be suffered by the Owner, if the Contractor does not substantially complete all work called for in the Contract Documents by the specified date, are of their very nature difficult of ascertainment. It is therefore expressly agreed that as part of the consideration inducing the Owner to execute this Contract, that the Owner will deduct from any final payment made to the Contractor a sum equal to $1000.00 per day for each and every calendar day beyond the agreed date which the CONTRACTOR shall require for substantial completion of the work included in this Contract. It is also expressly agreed that if the CONTRACTOR does not complete all punch list items within 30 days of submitting the punch list, the OWNER will deduct from any final payment made to the CONTRACTOR an additional sum equal to $500.00 per day for each and every calendar day beyond the 30 days given to the CONTRACTOR to complete the punch list items. It is also expressly agreed between the parties that in its sole discretion, the OWNER may contact the CONTRACTOR'S bonding company in the event that the OWNER believes that its rights under the performance bond related to the Project may be invoked. It is further understood that the above-referenced sums per day are agreed upon by the parties as a fair estimate of the pecuniary damages that will be sustained by the Owner in the event that the work is not substantially completed within the agreed upon time or the punch list is not completed in a timely manner. These sums shall be considered as liquidated damages only, and in no sense shall be considered a penalty, said damage being caused by additional compensation to personnel, loss of interest on money, inconvenience, disruption of the facility function, moving costs, loss of building use, and other miscellaneous increased costs, all of which are difficult of exact ascertainment.

8.4.1 The Owner’s use of the Substantially Complete facilities shall not be disrupted or prohibited in any way. Failure to complete and close-out the Project within 45 days after the scheduled Substantial Completion date will result in liquidated damages being assessed in the amount of $500.00 per day. If the CONTRACTOR is delayed through no fault of the OWNER, and Substantial Completion is not achieved by the agreed contract completion date, the PROJECT close-out period of 45 days will not be extended by the number of days of delay past the actual Substantial Completion date and will remain based upon the agreed contract completion date. The CONTRACTOR will be assessed any liquidated damaged amount for each day past such date, and such liquidated damages will be deducted from the final payment to the CONTRACTOR.

ARTICLE 9 PAYMENTS AND COMPLETION

9.1 SCHEDULE OF VALUES

Add Subparagraph 9.1.1 as follows:

9.1.1 The Schedule of Value shall be prepared and submitted as stipulated in Section 01 32 16 - Construction Schedules.

9.2 APPLICATIONS FOR PAYMENT

Delete Subparagraph 9.2.1 in its entirety and replace it with the following:

9.2.1 Payments will be made on account of materials or equipment that are suitably stored at some off site location meeting the following conditions:

a. The location must be agreed to, in writing, by the Owner and Surety.
b. The location must be a bonded warehouse.
c. Surety must agree, in writing, to each request for payment.
d. The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the off-site location.

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

Add Subparagraph 9.3.4 as follows:

9.2.2 The Contractor shall submit requests for payment in quadruplicate, on or before the 15th day of each month, using AIA Document G702, Application and Certificate of Payment, as the cover sheet. Continuation sheets showing in detail the amounts requested, etc., shall be submitted using AIA Document G703, Continuation Sheet, or a computerized version of these documents previously approved for use. The information provided on the continuation sheets in the Description of the Work and Scheduled Values columns shall match the corresponding information shown on the approved Schedule of Values. All blank spaces on AIA Document G702, Application and Certificate of Payment, must be completed and the signatures of the Contractor and Notary Public shall be original on each form. By submitting his application for payment, the Contractor certifies that the individual signing the application is authorized to do so.

9.3 PROGRESS PAYMENTS

Delete Subparagraph 9.6.1 in its entirety and replace it with the following:

9.3.1 After the Architect has issued a Certificate for Payment, the Owner shall make progress payments in accordance with the following subparagraph which shall be inserted as Article 5, Progress Payments, in the Owner-Contractor Agreement, AIA Document A101, 2017 Edition.

Based upon the applications for payment and supporting documents submitted to the Architect by the Contractor and certification of the amount payable by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided in the Contract Documents for the period ending the last day of the month as follows:

a. Not later than twenty-five (25) days following the end of the period covered by the Application for Payment, ninety-five percent (95%) of the portion of the Contract sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-five (95%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing (subject to the conditions listed in Article 9.3.2 of the Supplementary Conditions to the Contract for Construction), for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner.
b. Upon Substantial Completion of the entire Work, a sum sufficient to increase the total payments to ninety-five percent (95%) of the Contract Sum, less such amounts as the Architect shall determine for all incomplete Work and unsettled claims as provided in the Contract Documents.

At Subparagraph 9.6.2, add the following sentence after the first sentence:

More specifically, if only five percent (5%) retainage is withheld by the Owner on payments to the Contractor, then the Contractor shall withhold only five percent (5%) retainage on payments to subcontractors; and subcontractors shall withhold only five percent (5%) retainage on payments to sub-subcontractors.

9.4 FAILURE OF PAYMENT

9.4.1 Delete “or awarded by arbitration”.

9.5 SUBSTANTIAL COMPLETION

Add the following to Subparagraph 9.8.1

9.5.1 The following items are a partial list of requirements, as applicable, to the Project, that must be completed prior to established Substantial Completion.

a. All fire alarm system components must be completed and demonstrated to the Owner.
b. Local fire marshal approval certificate must be delivered to Owner.
c. All exterior clean-up and landscaping must be complete.
d. All final interior clean-up must be complete.
e. All HVAC air and water balancing must be complete.
f. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
g. All communications equipment, telephone system, security system and P.A. systems must be complete and demonstrated to the Owner.
h. All final lockset cores must be installed and all final Owner directed keying completed.
i. All room plaques and exterior signage must be complete.
j. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, lighting & sound system and electrical equipment.
k. A final Certificate of Occupancy must be signed by the Contractor and delivered to the Owner.
l. All operation and maintenance manuals are delivered and approved (“D-slant” ring binders in triplicate & CD electronic copy in pdf format categorized and filed according to specification number and product name) by Architect and/or Engineer.
m. All record drawings are delivered and approved.
n. All Material Safety Data Sheets are delivered and approved.

At Subparagraph 9.8.2, add the following sentence:

Should the Architect determine that the Contractor’s List of Items to be Completed or Corrected lacks sufficient detail or requires extensive supplementation, the list will be returned to the Contractor for revision, and the inspection for determining the Date of Substantial Completion will be delayed until the List submitted is a reasonable representation of the work to be done. The Architect, with the Owner’s consent, shall have the final authority to determine Substantial Completion.

Add Subparagraphs 9.5.2 and 9.5.3 as follows:

9.5.2 In order for the project or a major portion thereof to be considered substantially complete, the following conditions must be met:

a. All inspections by governmental authorities having jurisdiction over the project must have been finalized, any remedial work required by those authorities must have been completed, and Certificates of Occupancy and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.
b. All work, both interior and exterior, shall have been completed and cleaned except minor items which if completed after occupancy, will not, in the Owner’s opinion, cause interference to the Owner’s use of the building or any portion thereof. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.

9.5.3 After the date of Substantial Completion of the Project is evidenced by the Certificate of Substantial Completion, the Contractor will be allowed a period of thirty (30) days, unless extended by mutual agreement or provision of the Contract, within which to correct all deficiencies attached to the Certificate of Substantial Completion. Failure of the contractor to complete such corrections within the stipulated time will be reported to the Contractor’s surety. In this report, the Contractor and surety will be informed that, should correction remain incomplete for fifteen (15)

days, the Owner may initiate action to complete corrective work out of the remaining Contract funds in accordance with Article 14.2. Additional costs of the Owner, Architect, and other consultants incurred because of the Contractor's failure to complete the correction of deficiencies within 30 days after the date of Substantial Completion (unless extended by mutual agreement or provision of the Contract) will be deducted from the funds remaining to be paid to the Contractor.

a. Should corrective work following Substantial Completion require more than one re-inspection after notification by the Contractor that corrections are complete, the cost of subsequent inspections may also be deducted from the Contract funds remaining unpaid to the Contractor.

9.6 FINAL COMPLETION AND FINAL PAYMENT

At Subparagraph 9.10.2, add the following sentence:

Prior to final payment, the Contractor shall meet all of the requirements of Section 01 77 00, Construction Contract Close out.

Add Subparagraph 9.10.6 as follows:

9.6.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner, to the Contractor, thirty-one (31) days after Substantial Completion of the work unless otherwise stipulated in the Certificate of Substantial Completion, provided the Work has been completed, the Contract fully performed, all of the requirements of Section 01 77 00, Construction Close Out are met, and the final Certificate for Payment has been issued by the Architect. The final payment will not be made until all of these conditions are met.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

10.1 HAZARDOUS MATERIALS

Add Subparagraphs 10.1.1 and 10.1.2 as follows:

10.1.1 The use of any construction process or the installation of any materials containing the hazardous materials listed in paragraph 9.3 of Instructions to Bidders is strictly prohibited on this project.

10.1.2 As part of the construction contract close out process, and prior to receiving payment of any of the retainage, the Contractor and certain of his subcontractors shall submit notarized statements pertaining to the above referenced hazardous materials. Refer to Section 01 77 00, Construction Contract Close Out.

ARTICLE 11 INSURANCE AND BONDS

11.1 CONTRACTOR'S LIABILITY INSURANCE

At Subparagraph 11.1.1, add the following subparagraphs:

a. Liability insurance shall include all major divisions of coverage and be on a comprehensive basis including:
   (1) Premises Operations (including X, C, and U coverages)
   (2) Independent Contractors
   (3) Products and Completed Operations
   (4) Personal Injury Liability with Employee Exclusion delete
   (5) Contractual, including specified provision for Contractor's obligation under Paragraph 3.18
   (6) Owned, non-owned and hired vehicles
   (7) Broad Form Property Damage including Completed Operations
   (8) If the General Liability coverages are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2.

At Subparagraph 11.1.2, delete the first sentence in its entirety and replace it with the following:

The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits or the limits required by law, whichever coverage is greater:

a. Workers' Compensation:
   (1) State: Texas - Statutory
   (2) Applicable Federal – Statutory
   (3) Employer's Liability
       $100,000 per Accident
       $500,000 per Disease, Policy Limit
       $100,000 per Disease, Each Employee

b. Commercial General Liability minimum insurance limits:
   General Liability
   (1) Bodily Injury and Property Damage Combined:
       $500,000 Each Occurrence
       $500,000 Aggregate
   (2) Damage to rented premises
       $100,000 each occurrence
   (3) Medical Expenses
       $10,000 any one person
   (4) Personal and Adv. Injury
       $500,000 each occurrence
       $500,000 aggregate
   (5) General Aggregate
       $1,000,000 aggregate
   (6) Products & Completed Operations
       $500,000 each occurrence
       $500,000 aggregate
       -Shall be maintained for at least one year after Substantial Completion and certificates shall be filed with the OWNER during this period.
       -Property Damage Liability Insurance shall provide X, C, and U coverage.
       -Broad Form Property Damage Coverage shall include Completed Operations.

c. OWNER'S and CONTRACTOR'S Protective Liability Insurance (OPLI):
   Naming the OWNER as the insured
   (1) $1,000,000 each occurrence
   (2) $1,000,000 aggregate

11.1.1 Endorse to include officers and employees of OWNER, ARCHITECT, and ENGINEER
   a. Written by the same insurance company as the Commercial General Liability policy
   b. If this requirement is redundant, insurance broker must provide a letter that the General Liability policy will cover the same items that the OWNER Protective Liability Insurance would cover. A copy of the letter must be maintained with the contract documents.
   c. Insurance Company Values and Size
      (1) Best rating of A or better required.
   d. Cancellation Notice: 30-day cancellation notice required on all policies
   e. Bonds
      (1) Payment Bond (100% of Contract amount for contracts $25,000 or over)
      (2) Performance Bond (100% of Contract amount for contracts $100,000 or over)

   At Subparagraph 11.1.1, add the following sentence:

11.1.2 Proof of insurance shall be evidenced on 1) an original ACORD Certificate of Insurance 25-S (7/90) and 2) an original Supplemental Attachment for ACORD Certificate of Insurance 25-S (7/90), AIA Document G715-1991, each with an original signature of the Authorized Representative. Policy exclusions and/or restrictions should be clearly explained on the Certificate or in an attached letter from the issuing agency. Blank areas on the Certificate should have "not covered" written across the printed areas when coverage is not provided.

Add Subparagraph 11.1.2 as follows:

11.1.3 Insurance shall be underwritten by a company rated not less than A in Best's latest published guide.

11.2 OWNER'S LIABILITY INSURANCE

Delete Subparagraphs 11.2.1 in its entirety and replace it with the following:

11.2.1 The Contractor shall be responsible for purchasing and maintaining Owner's Protective Liability Insurance naming the Owner as insured with the stated limit to be per occurrence as primary limit (combined single limit, irrespective of whether occurrence consists of personal injury, death, property damage, or combination thereof). The policy shall cover the work to be performed for the Owner by the Contractor and all subcontractors. The definition of insured in the policy shall be endorsed to include officers, employees of the Owner, while acting within the scope of employment or function for the Owner with respect to the work performed by the Contractor; the project architect and his consultants, as listed in the Bidding Documents, shall also be included as additional insureds. The policy shall be written with the same company as the Comprehensive General Liability policy.

Limits: $1,000,000

Add Subparagraph 11.2.2 as follows:

11.2.2 Refer to subparagraph 11.1.4 for additional requirements that apply to this paragraph also.

11.3 PROJECT MANAGEMENT PROTECTIVE LIABILITY INSURANCE

Delete paragraph 11.3 in its entirety.

11.4 PROPERTY INSURANCE

Delete Subparagraphs 11.4.1 through 11.4.10 in their entirety and replace them with the following:

11.4.1 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance in the amount of the initial Contract Sum as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis without voluntary deductibles. Such property insurance shall be maintained until final payment has been made as provided in Paragraph 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Paragraph 11.3 to be covered, whichever is earlier. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Work.

11.4.2 Property insurance shall be on an all-risk policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, falsework, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's services and expenses required as a result of such insured loss. This insurance is not intended to cover machinery, tools or equipment owned or rented by the Contractor which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment. Coverage of other perils shall not be required unless otherwise provided in the Contract Documents.

11.4.3 The property insurance shall include an endorsement allowing Owner occupancy and the insurance shall not be altered on account of partial occupancy prior to final completion.

11.4.4 If the property insurance requires minimum deductibles and such deductibles are identified in the Contract Documents, the Contractor shall pay costs not covered because of such deductibles.

11.4.5 This property insurance shall cover portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also portions of the Work in transit.

11.4.6 Before any exposure to loss may occur, the Contractor shall file with the Owner a copy of each policy that includes insurance coverages required by this Paragraph 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to

this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to the Owner.

11.4.7 The Owner or Contractor waive all rights against 1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other and 2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this Paragraph 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

11.4.8 A loss under the Contractor's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insured, as their interests may appear. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

11.4.9 If required in writing by a party in interest, the owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach. If after such loss no other special agreement is made, replacement of damaged property shall be covered by appropriate Change Order.

11.4.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers.

11.5 PERFORMANCE BOND AND PAYMENT BOND

Add Subparagraphs 11.5.3, 11.5.4 and 11.5.5 as follows:

11.5.1 The Performance Bond Form and The Payment Bond Form included herein shall be executed and submitted to the Architect in duplicate prior to commencement of the work. The surety companies must be acceptable to the Owner and licensed admitted carriers in the State of Texas; and the companies must appear in a current Federal Treasury list as Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies.

11.5.2 Each bond shall be of penal sum equal to 100% of the Contract Sum and shall be compatible with the provisions of the governing authority. The Contractor shall file copies of each bond with the county clerk and furnish the Owner with a file receipt. The bonds shall remain in force throughout the warranty period of the contract. The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an authorized power of attorney attached.

11.5.3 Claims must be sent to the Contractor and his Surety in accordance with Article 5160, Revised Civil Statutes. The Owner will furnish in accordance with such Article, a copy of the Payment Bond as provided therein to claimants upon request. All claimants are cautioned that no lien exists on the funds unpaid to the Contractor on such Contract, and that reliance on notices sent to the Owner may result in loss of their rights against the Contractor and/or his Surety. The Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts not such responsibility because of any representation by any agent or employee.

Add Paragraph 11.6 as follows:

11.6 WORKER'S COMPENSATION INSURANCE COVERAGE

11.6.1 Comply with the requirements of Rule 28, TAC §110.110, Reporting Requirements for Building or Construction Projects for Governmental Entities.

11.6.2 **DEFINITIONS:**

a. Certificate of coverage ("certificate"). A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.

b. Duration of the project – includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.

c. Persons providing services on the project ("subcontractor" in §406.096) – includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity which furnishes persons to provide services on the project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor transportation, or other service related to the project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply delivery, and delivery of portable toilets.

11.6.3 The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the contractor providing services on the project, for the duration of the project.

11.6.4 The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

11.6.5 If the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project, the contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

11.6.6 The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

a. A certificate of coverage, prior to that person beginning work on the projects, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project; and

b. No later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

11.6.7 The Contractor shall retain all required certificate of coverage for the duration of the project and for one year thereafter.

11.6.8 The Contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

11.6.9 The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Worker's Compensation, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

11.6.10 The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

a. Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;
b. Provide to the Contractor, prior to the person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project;
c. Provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate ends during the duration of the project;
d. Obtain from each other person with whom it contracts, and provides to the Contractor:
   (1) a certificate of coverage, prior to the other person beginning work on the project; and
   (2) a new certificate of coverage, showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
e. Retain all required certificates of coverage on file for the duration of the project and for one year thereafter;
f. Notify the governmental entity in writing by certificate mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and
g. Contractually require each person with whom it contracts, to perform as required by paragraphs (1) – (7), with the certificates of coverage to be provided to the person for whom they are providing services.

11.6.11 By signing this contract or providing or causing to be provided a certificate of coverage, the contractor is representing to the governmental entity that all employees of the Contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other actions.

11.6.12 The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE OWNER FOR CONVENIENCE

At Subparagraph 14.1.2, delete the words "¼along with reasonable overhead and profit on the Work not executed".

ARTICLE 15 CLAIMS AND DISPUTES

15.1 CLAIMS

15.1.1 Correct "21 days" to read "90 days".

15.2 MEDIATION

Delete Subparagraph 15.3.2 in its entirety and replace it with the following:

15.2.1 The parties shall endeavor to resolve their claims by mediation which, unless the parties mutually agree otherwise, shall in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract. Mediation shall proceed in advance of legal or equitable

proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order.

Delete Paragraph 15.4 in its entirety and all references to Arbitration.

END OF SECTION 00 73 00

SECTION 00 73 43
PREVAILING WAGE RATE

1.01

Pay no less than the wages stated in the Owner's schedule of Prevailing Wage Rates, bound herein immediately following this Document. No claims for additional compensation will be considered because of payments of wage rates in excess of applicable rates contained therein. If prevailing rates listed are thought to be inaccurate, report suspected discrepancies to the Architect and the Owner.

1.02

Applicable Statutes: Texas Government Code, Sections 2258.021-.026, 2258.051-.058.

A. A contractor or subcontractor which violates this act shall forfeit as a penalty to the Owner the statutory penalty of sixty dollars ($60.00) per worker for each day or portion of a day said worker is paid less than the applicable stipulated rate for any work done under this Contract.

B. The Contractor and each subcontractor shall keep, or cause to be kept, an accurate record showing the names and occupants of all workers employed in connection with the Work, and showing also the number of hours actually worked per day, the actual hourly rate and the actual per diem wages paid to each of such workers, which record shall be open at all reasonable hours to the inspection of the Owner.

C. Contractor and each subcontractor shall each complete wage rate surveys on copies of three-page forms available from the Owner and submit to Owner no later than the submittal of the second application for payment.

1.03

Prevailing wages shall not be constructed to prohibit the payment of more than the rates stated. Under no condition shall any worker employed on this job be paid less than the applicable minimum prevailing wage.

1.04

Comply with all applicable laws, including but not limited to laws concerned with labor, equal employment opportunity, health and safety, and minimum wages.

1.05

Apprentice Pay: Only apprentices in an approved program may be paid apprenticeship rates. Minimum rates for apprentices in all trades and crafts shall be the rates determined by approved apprenticeship programs, or $1.00 per hour less than journeyman's rates, whichever are lower. Approved apprenticeship programs are those approved by the U.S. Department of Labor, Bureau of Apprenticeship Training.

1.06

Calculation of Rates:

A. Base Per Diem Rate: Multiply hours worked per day by base hourly rate.

B. Overtime (over 40 hours per week, and holidays): Multiply base hourly rate by one and one-half (1.5).

1.07

Prevailing Wage Rate Determination Information: Reference Hays County, Report dated 05/18/2026.

END OF SECTION 00 73 43

"General Decision Number: TX20260254 05/18/2026

State: Texas

Construction Types: Building

Counties: Texas Counties of
Hays

Modification Number	Publication Date
0	01/02/2026
1	05/18/2026

ASBE0087-014 06/03/2024

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (DUCT, PIPE AND MECHANICAL SYSTEM INSULATION)	$ 29.50	8.79

BOIL0074-003 01/01/2025

	Rates	Fringes
BOILERMAKER	$ 33.17	24.92

ELEC0520-004 01/03/2022

	Rates	Fringes
ELECTRICIAN (LOW VOLTAGE WIRING ONLY)	$ 31.52	9.20

ELEV0133-002 01/01/2025

	Rates	Fringes
ELEVATOR MECHANIC FOOTNOTE: A. 6% UNDER 5 YEARS BASED ON REGULAR HOURLY RATE FOR ALL HOURS WORKED. 8% OVER 5 YEARS BASED ON REGULAR HOURLY RATE FOR ALL HOURS WORKED. B. HOLIDAYS: NEW YEAR'S DAY, MEMORIAL DAY, INDEPENDENCE DAY, LABOR DAY, THANKSGIVING DAY, THE FRIDAY AFTER THANKSGIVING DAY, CHRISTMAS DAY, AND VETERANS DAY	$ 51.59	38.44

ENGI0450-002 04/01/2024

	Rates	Fringes
POWER EQUIPMENT OPERATOR (CRANES)	$ 39.47	10.39

IRON0084-011 06/01/2024

	Rates	Fringes
IRONWORKER: ORNAMENTAL	$ 28.26	8.13

IRON0482-012 06/01/2025

	Rates	Fringes
IRONWORKER, STRUCTURAL	$ 28.30	8.23

PLUM0286-009 06/05/2023

	Rates	Fringes
PIPEFITTER: INCLUDING HVAC PIPE INSTALLATION	$ 34.15	15.77
HVAC MECHANIC (HVAC UNIT INSTALLATION ONLY)	$ 37.15	16.92

PLUM0286-009 09/01/2025

	Rates	Fringes
PIPEFITTER: INCLUDING HVAC PIPE INSTALLATION	$ 34.15	15.77
HVAC MECHANIC (HVAC UNIT INSTALLATION ONLY)	$ 37.15	16.92

SFTX0669-002 04/01/2025

	Rates	Fringes
SPRINKLER FITTER (FIRE SPRINKLERS)	$ 38.57	24.47

SHEE0067-006 07/01/2025

	Rates	Fringes
SHEET METAL WORKER (EXCLUDES HVAC DUCT INSTALLATION)	$ 34.01	16.10

SUTX2014-030 07/21/2014

	Rates	Fringes
WATERPROOFER	$ 16.30	0.06
TRUCK DRIVER: WATER TRUCK	$ 12.00	4.11
TRUCK DRIVER: SEMI-TRAILER TRUCK	$ 12.50	0.00
TRUCK DRIVER: FLATBED TRUCK	$ 19.65	8.57
TRUCK DRIVER: DUMP TRUCK	$ 12.39	1.18
TILE SETTER	$ 15.38	0.00
TILE FINISHER	$ 11.32	0.00
SHEET METAL WORKER (HVAC DUCT INSTALLATION ONLY)	$ 17.84	3.26
ROOFER	$ 12.00	0.00
PLUMBER, EXCLUDES HVAC PIPE INSTALLATION	$ 21.58	2.88
PAINTER: BRUSH, ROLLER, AND SPRAY	$ 18.76	6.35
OPERATOR: ROLLER	$ 11.25	0.00
OPERATOR: PAVER (ASPHALT, AGGREGATE, AND CONCRETE)	$ 16.03	0.00
OPERATOR: MECHANIC	$ 18.75	5.12
OPERATOR: LOADER	$ 14.00	0.00
OPERATOR: GRADER/BLADE	$ 19.30	0.00
OPERATOR: FORKLIFT	$ 15.68	0.00
OPERATOR: DRILL	$ 14.50	0.00
OPERATOR: BULLDOZER	$ 14.00	0.00
OPERATOR: BOBCAT/SKID STEER/SKID LOADER	$ 13.00	0.00
OPERATOR: BACKHOE/EXCAVATOR/TRACKHOE	$ 19.43	3.49
LABORER: ROOF TEAROFF	$ 11.28	0.00
LABORER: PIPELAYER	$ 12.45	0.00
LABORER: MASON TENDER - CEMENT/CONCRETE	$ 11.85	0.00
LABORER: MASON TENDER - BRICK	$ 11.00	0.00
LABORER: COMMON OR GENERAL	$ 10.43	0.00
IRONWORKER, REINFORCING	$ 12.27	0.00
GLAZIER	$ 12.83	0.00
FLOOR LAYER: CARPET	$ 21.88	0.00
ELECTRICIAN, EXCLUDES LOW VOLTAGE WIRING	$ 24.00	3.66
ELECTRICAL INSTALLER (SOUND AND COMMUNICATION SYSTEMS ONLY)EXCLUDES WIRING	$ 12.50	0.65
DRYWALL HANGER AND METAL STUD INSTALLER	$ 14.00	0.00
DRYWALL FINISHER/TAPER	$ 16.96	4.34
CEMENT MASON/CONCRETE FINISHER	$ 15.71	0.00
CARPENTER, EXCLUDES ACOUSTICAL CEILING INSTALLATION, DRYWALL HANGING, FORM WORK, AND METAL STUD INSTALLATION	$ 13.99	0.00

CARPENTER (FORM WORK ONLY).....$ 15.62 0.05
CARPENTER (ACOUSTICAL CEILING INSTALLATION ONLY)....$ 14.00 0.00
BRICKLAYER.....$ 20.86 0.00

WELDERS - Receive rate prescribed for craft performing
operation to which welding is incidental.
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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Note: Executive Order 13658 generally applies to contracts subject to the Davis-Bacon Act that were awarded on or between January 1, 2015 and January 29, 2022, and that have not been renewed or extended on or after January 30, 2022. Executive Order 13658 does not apply to contracts subject only to the Davis-Bacon Related Acts regardless of when they were awarded. If a contract is subject to Executive Order 13658, the contractor must pay all covered workers at least $13.65 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract from May 11, 2026, through December 31, 2026. The applicable Executive Order minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under Executive Order 13658 is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than
�SU�, �UAVG�, �SA�, or �SC� denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council

number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The "SU" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

"SU" wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The "SA" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the "SA" identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION

"

SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.01 THE WORK

A. The Work of this Contract ("the Work"): New Fire Station.

B. Major Items of Work: The Work of this Contract includes (but is NOT limited to) the following:
   1. Earthwork, Landscaping
   2. Concrete Foundations, Slabs, Paving
   3. Concrete Masonry Walls, Partitions and Masonry Veneer
   4. Miscellaneous Carpentry and Architectural Woodwork
   5. Roofing and Insulation
   6. Hollow Metal Work, Plastic Finished Wood Doors, Finish Hardware, Glazing
   7. Porcelain Tile, Lay-in Ceilings, and Painting
   8. Toilet Accessories, Fire Extinguishers, and Signage
   9. Plumbing, Heating, Ventilation and Air Conditioning
   10. Electrical Work
   11. Structural Components, Columns, Beams, Supports, etc.
   12. Demolition Work

1.02 WORK BY OTHERS

A. The Owner reserves the right to engage other entities to perform certain items of work related to the project.

B. Owner-Furnished Items: Refer to the Drawings and to various Sections of these Specifications for information regarding items (if any) that are to be furnished by Owner but installed by the Contractor, and items to be furnished by Owner and installed by Owner's personnel.

1.03 COORDINATION

A. Coordination With Other Contractors: Coordinate operations and share the site with other contractors (if any) as necessary for successful completion of the Project. Coordinate all requirements for access, scheduling, phasing, and relationships between the work of various contracts and trades as necessary to ensure proper installation, alignment, connection, adjustment, cleaning, and protection of all work of the Project.
   1. Communicate with other Owner's personnel and Owner's other contractors as necessary to adequately coordinate operations of the various contractors.
   2. During Work, allow access by other contractor(s) invited by the Owner to bid or negotiate other work, as necessary for examination of site conditions and work in progress.

PART 2 - PRODUCTS (NOT USED)

PART - 3 EXECUTION (NOT USED)

END OF SECTION 01 11 00

SECTION 01 16 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 QUALITY ASSURANCE

A. Compatibility: When given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.02 PRODUCTS DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods to prevent damage, deterioration and loss, including theft.
   1. Schedule delivery to minimize storage at the site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation to ensure minimum holding time for items that are flammable, hazardous, easily damaged or sensitive to deterioration, theft and other losses.
   3. Deliver products to the site in the manufacturer’s original sealed containers or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
   5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
   6. Store heavy materials in a manner that will not endanger supporting construction.
   7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer’s instructions.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

A. General Requirements: Provide products complying with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
   1. Provide products complete with all accessories, trim, finish, and other items needed for a complete installation and for the intended use and effect.
   2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures:
   1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated; no substitution permitted.
   2. Semi-proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated; no substitution will be permitted. Where products or manufacturers are specified by name, accompanied by the term “or equal”, or a similar term, submit evidence as specified below under Substitutions.
   3. Non-Proprietary Specifications: When Specifications list products or manufactures that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Substitutions requirements below to obtain approval for use of an unnamed product.
   4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

5. Performance Specifications Requirements: Where Specifications require compliance with performance requirements, provide products that that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance is implied where the product is specified for a specified application. Manufacturer's recommendations may be in published literature or by the manufacturer's certification of performance.
6. Codes and Standards: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, code or regulations specified.
7. Visual Matching: Where Specifications require matching an established Sample, Architect's decision on whether match is satisfactory will be final.
8. Visual Selection: Where specified requirements include the phrase "as selected from manufacturer's standard colors and patterns" or similar clause, select products and manufacturers complying with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.
9. Substitutions: Substitutions will only be considered when specific materials are no longer available, no longer meet code requirements, or equivalent materials will save the Owner a significant amount of money.

C. Substitutions: For proposed substitutions, submit evidence for review by Architect, who shall be the sole judges of equivalency, that such products are equivalent in every significant way to those specified; indicate cost savings. Bear responsibility for all incurred in coordination and modifying other work to accommodate substitutions.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place accurately located and aligned with other Work.

3.02 CLEANING

A. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01 16 00

SECTION 01 21 00
ALLOWANCES

PART 1 GENERAL

1.01 SUMMARY

A. ALLOWANCES: Except as otherwise stated, allowance amounts below are for the purchase, installation, materials and labor. No Contractor mark-ups allowed on Allowance items. Include mark-up, if any, in Base Proposal.

B. UNIT PRICES: Unless otherwise stated, unit prices below include execution and all other related costs.

C. Work included in Allowances and Unit Prices may be separately purchased by Owner or contracted separately by Owner and assigned to Contractor as a subcontract.

PART 2 PRODUCTS (NOT APPLICABLE TO THIS SECTION)

PART 3 EXECUTION

3.01 LUMP SUM ALLOWANCES BASE BID

A. Owner’s Unforeseen Contingency: $ 250,000.00

TOTAL ALLOWANCES: $ 250,000.00

END OF SECTION 01 21 00

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. This Section identifies each Alternate and describes the intent and basic changes to Work only when that Alternate as listed below is made a part of the Work by specific provisions in the Contract.
   2. Base Bid and Alternate(s) shall include costs of all supporting elements required so that the combination of Base Bid and Alternate(s) are complete.

B. Related Documents: Drawings, Specifications and General Provisions to General Contractor and Subcontractors.

1.02 DEFINITIONS

A. Alternates:
   1. Bid Alternate No. 1:
      a. Provide Building C as described by the contract documents.
   2. Bid Alternate No. 2:
      a. Provide 14,000 Gallon Rain Harvesting Tank as decribed in the contract documents.
   3. Bid Alternate No. 3:
      a. Provide Site Fencing and Gates as described by the contract documents. All conduits backboxes, and pathways are part of Base Bid.
   4. Bid Alternate No. 4:
      a. Provide Sub-surface drainage for Artificial Turf Area as described by the contract documents.
   5. Bid Alternate No. 5:
      a. Provide Alternate Exteriors Materials as described by the contract documents.
   6. Bid Alternate No. 6:
      a. Replace all in-wall insulation with closed-cell spray insulating foam to a depth of 6".
   7. Bid Alternate No. 7:
      a. Provide Copper secondary feeders as described in the contract documents.
   8. Deductive Alternate No. 1:
      a. Remove Bay 1 from Apparatus Bay scope as defined in the contract documents.

B. The Owners reserves the right to award Alternate(s) by means of none, any or all in any order or combination.

C. Alternates shall not be awarded without the award of the Base Bid.

D. The Owner reserves the right to determine and score proposals as Base Bid alone or sum of Base Bid and any combination of Alternate(s).

E. Base Bid shall include all work for a complete project.

F. Except as otherwise indicated, work shall be completed as described in Altercate(s) with no increase in Contract Time.

G. This Section shall be interpreted and included non-technical description of Alternate(s). Refer to Drawings and Specifications for technical descriptions of Alternate(s) and Scope of Work.

H. Coordinate related work and modify surrounding work as required to integrate Alternate(s) into the Scope of Work.

I. Base Bid and Alternate(s) are exclusive in their Scope of Work. There is no overlap between or among Base Bid and Alternate(s). The Cost of Work shall be included only once in Base Bid or in Alternate(s).

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 23 00

SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

1.02 DEFINITION

A. Definitions used in this Article are not intended to change or modify the meaning of other terms use in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for “substitutions”. Substitutions for specified items will not be considered during the Bid Period. The following are not considered substitutions:
   1. Changes made by the Owner, the Architect, or their consultants by Addenda, which are considered to be apart of the Work of the Construction Contract.
   2. Revisions to Contract Documents requested by the Owner or Architect.
   3. Specified options of products and methods included in Contract Documents
   4. The Contractor’s determination of and compliance with governing regulations and orders issued by governing authorities.

1.03 SUBMITTALS

A. Substitution Requests Submittal: Requests for substitution will be considered if received within 10 working days after commencement of the Work. Requests received more than 10 working days after commencement of the Work may be considered or rejected at the discretion of the Owner and/or Architect.
   1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
   2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate.
      a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
      b. Samples, where applicable or requested.
      c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant Qualities may include elements such as size, weight, durability, performance and visual effect.
      d. Coordination information, including a list of changes or modifications to other parts of the Work, and to construction performed by the Owner and Separate Contractors, that will become necessary to accommodate the proposed substitution.
      e. A statement indicating the substitution’s effect on the Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
      f. Cost of information, including any proposed net change on Contract Sum.
      g. Certification by the Contractor that the proposed substitution is in every significant respect equal to or better than that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor’s waiver of rights to the failure of the substitution to perform adequately.
   3. Action: Within one week of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution.

If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the specified product. Acceptance will be in the form of a Change Order, or, if not change in the Contract Sum or Contract Time, a Field Order or Change Bulletin.

PART 2 PRODUCTS

2.01 SUBSTITUTIONS

A. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
   1. Extensive revisions to Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of Contract Documents.
   3. The request is timely, fully documented and properly submitted.
   4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
   5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product of method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
   6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
   7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of the other construction by the Owner or separate Contractors, and similar considerations.
   8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and Contractor certifies that the substitution can over come the incompatibility.
   9. The specified product of method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
   10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution will provide the required warranty.

B. The contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART 3 EXECUTION (NOT USED)

END OF SECTION 01 25 13

SUBSTITUTION REQUEST

PROJECT: Hays County ESD #4
Fire Station #42

SUBSTITUTION No.:

DATE:

TO: Martinez Architects, LP
900 Rockmead, Suite 250
Houston, Texas 77339

From:

Copies:

☐ Owner ☐ Architect ☐ Consultant

Specification Section:

Drawing Reference: Detail(s):

Proposed Substitution:

Manufacturer:

Trade Name:

Manufacturer Contact Information: Address

Phone Number

Installer Contact Information: Address

Phone Number

Product History: ☐ New Product ☐ 2-5 yrs. ☐ 5-10 yrs. ☐ 10+ yrs.

Similar Installation(s):

Project: Architect:

Address: Owner:

Date Installed:

Substitution affect other areas: ☐ No ☐ Yes; Explain

Product Differences:

Reason for Request:

Savings to Owner for Accepting Substitution: ☐ No ☐ Yes $

Change to Contract Time for Accepting Substitution: ☐ No ☐ Yes $

Additional Information / Attachments:
☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports
☐ Other

Request By:
Date:

SECTION 01 26 00
CONTRACT MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Submit proposals for changes to the Work when required. Prepare documents in a form acceptable to the Owner.

B. Make Changes in the Work as described in approved documents signed by the Owner.

C. Make other changes in the Work as described in Change Proposal Requests, Change Bulletins and/or Field Orders issued by the Architect, when such changes do not involve a change in the Contract Sum or Sum Time.

D. Related Requirements: Methods of determining the amount of Change Orders are set forth in the Construction Contract.

1.02 DEFINITIONS

A. Change Order: A document signed by the Owner authorizing a change in the Work, in the Contract Sum, in the Contract Time, or any combination thereof.

B. Change Bulletin or Field Order: A document issued by the Architect that clarifies or changes the Word in a minor way that may or may not require a change in the Contract Sum or Contract Time. A description of the action expected of the Contractor will be a part of each Bulletin or Field Order.

C. Change Proposal Request or Clarification: A document issued by the Architect that clarifies or changes the work in a minor way that does not require a change in the Contract Sum or Contract Time. A description of the action of the Contractor will be part of each Change Proposal Request or Clarification.

D. Allowance Expenditure Authorization: A document signed by the Architect, Owner, and Contractor authorizing a Change Proposal Request to be funded by Allowance, and does not affect the Contract Sum, the Contract Time, or any combination thereof.

PART 2 NOT USED

PART 3 EXECUTION

3.01 CHANGES INITIATED BY THE OWNER

A. If the Owner contemplates making a change in the Work that will affect the Contract Sum or Contract Time, the Owner will initiate the issuance of a Change Bulletin by the Architect including or accompanied by a description of the action required by the proposed change.
   1. If the action described required a proposal from the Contractor, the Contractor shall submit such proposal within 10 working days.
   2. The Owner will review and respond to the Contractor’s proposal within 10 working days after its receipt.

B. If the description requires Contractor to proceed with work that will be submitted in the future as a Change Order, Contractor shall expeditiously proceed with the Work described in the Bulletin and submit documentation for inclusion in a Change Order once Work covered by the Bulletin is completed or as soon as final cost/time is determined.

C. If the Owner contemplates making a change in the Work that will not affect the Contract Sum or Contract time using Allowance funds, the Owner will initiate the issuance of a Change Proposal Request by the Architect including or accompanied by a description of the action required by the proposed change. The Contractor will then price said change for the Owner and Architects review. Once all parties agree to proposed pricing, the Architect shall issue a Allowance Expenditure Authorization.

3.02 CHANGES INITIATED BY THE CONTRACTOR

A. Should the Contactor discover a discrepancy in the Contract documents not previously noted or determine on receipt of a Change Bulletin or Field Order that the Work described therein will necessitate a change, contractor shall notify the Architect and Owner in writing within 5 working days if such discovery or determination, and of the intent to submit a Change Order or Change Proposal Request for the work involved.

B. Within 10 working days of such notice, the Contractor shall submit a Change Order or Change Proposal Request to the Owner and Architect. Request shall state:
   1. Proposed change in Contract Sum and/or Contract Time if required.
   2. Description of other changes in the Work required by the proposed change, or desirable therewith, if any.
   3. Substantiation of costs or time involved as described below.

3.03 COORDINATION

A. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum as shown in the Change Order.

B. Promptly revise Progress Schedule to reflect any change in Contract Time, revise schedules to adjust times for other items of work affected by the change and resubmit.

3.04 DISPUTES

A. If the Contractor and/or Owner disagree about the value of the proposed change in the Contract Sum or Contract Time, the one shall notify the other in writing, stating the reason for the disagreement.
   1. A disagreement about the value of a Change Order does not relieve the Contractor of responsibility to proceed with the change as ordered and to seek settlement of the dispute under the pertinent provisions of the Contract Documents.

B. In the event that the Owner and Contractor can not agree on cost associated with a Change Order, the Owner may direct the Contractor to carry out the work on a "Time and Material" basis with a "Not to Exceed", in order to allow the work to move forward.

3.05 WORK ON CHANGES

A. Work on proposed changes that affect the Contract Sum shall not be started until an approved Change Order has been received by the Contractor, unless otherwise directed by the Owner in writing.

B. In all cases, the Contractor shall maintain an accurate account of all labor and materials involved in the change.

END OF SECTION 01 26 00

SECTION 01 26 13
REQUESTS FOR INTERPRETATION

PART 1 GENERAL

1.01 SUMMARY

A. This section includes administrative provisions for submitting and processing Requests for Interpretation (RFIs) after execution of the Agreement.

1.02 DEFINITIONS

A. RFI: Request from the Contractor seeking interpretation or clarification of the Contract Documents.

1.03 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS

A. General: Carefully study and compare Contract Documents with existing conditions at Project site and shall at once report in writing to Architect any error, inconsistency or omission discovered or any materials, systems, procedures, or methods of construction, either shown on the Drawings or specified, which the Contractor feels are incorrect, inadequate, obsolete, or unsuitable for purpose needed.

B. Before starting each portion of the Work, carefully study and compare the various Drawings and other Contract Documents related to that portion of the Work, and information furnished by the Owner, take the field measurements of existing conditions related to that portion of the Work, and observe conditions at the site.

C. Any errors, discrepancies, inconsistencies, or omissions discovered shall be promptly reported to the Architect as a request for interpretation.

D. Contractor shall not proceed with the Work without written clarification from the Architect.

E. In the case of discrepancies between Drawings and Specifications, or within either Document not clarified by Addendum, promptly submit written request to the Architect as a request for interpretation.

F. Contractor shall not proceed with the Work without written clarification from the Architect.

G. Contractor shall request clarification in sufficient time to avoid delays and increase in the Contract Sum.

H. Contractor’s failure to report discrepancies of omissions in the Contract of Documents, or Contractor- or Subcontractor-generated assumptions, in lieu of Architect-issued clarifications regarding the intent of the Contract Documents, shall not be used a basis for future claims once the apparent discrepancies or omissions have been reconciled by appropriate interpretation issued by the Architect.

1.04 REQUESTS FOR INTERPRETATION (RFIS)

A. Procedure: Immediately on discovery of the need for interpretations of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form Specified.
   1. RFIs shall be originated with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor’s work or work of subcontractors.

B. Content or the RFI: Include a detailed, legible description of item needed interpretation and the following:
   1. Project name.
   2. Date.
   3. Name of Contractor.
   4. Name of Architect.
   5. RFI number, numbered sequentially.

6. Specification Section number and title and related paragraphs, as appropriate.
7. Drawing number and detail references, as appropriate.
8. Field dimensions and conditions, as appropriate.
9. Contractor's suggested solution(s). If Contractors solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
10. Contractor's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    a. Supplementary drawings prepared by Contractor shall include dimensions, thickness, structural grid references, and details of affected materials, assemblies, and attachments.

C. Hard-Copy RFIs: Included at the end of this Section.
   1. Identify each page of attachments with the RFI number and sequential page number.

D. Software-Generated RFIs: General Contractor shall request a copy of the file from the Architect.

E. Electronic files shall be submitted in Adobe acrobat PDF format.

F. Architect's Actions: Architect will review each RFI, determine action required, and return it. Allow three working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day. If more information is needed, the RFI should be returned by the Architect within the 3-day period, stating such.
   1. The following RFIs will be returned without action:
      a. Requests for reproval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for coordination information already indicated in the Contract Documents.
      d. Requests for adjustments in the Contract Time or the Contract Sum.
      e. Requests for interpretation of Architect's actions on submittals.
      f. Incomplete RFIs or RFIs with numerous errors.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 13, Contract Modification Procedures.
   4. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
   5. RFIs involving request for remedial action to correct nonconforming work, which are returned in more than fourteen working days, are not eligible for Contractor's request for an increase in Contract Sum or an extension of Contract Time.
   6. Where any action or response falls due on a Saturday, Sunday, or legal holiday, such action or response shall be considered due on the next business day which is not a Saturday, Sunday, or a legal holiday.

G. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within ten days if the Contractor disagrees with response.

H. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit updated log at each Construction Progress Meeting. Provide software log with not less than the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number including RFIs that were dropped and not submitted.
   5. RFI description.
   6. Date the RFI was submitted.

7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal request, as appropriate.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 ATTACHMENTS

A. Request for Interpretation.

END OF SECTION 01 26 13

REQUEST FOR INTERPRETATION

PROJECT: Hays County ESD #4
Fire Station #42

RFI No.:

DATE:

TO: Martinez Architects, LP
900 Rockmead, Suite 250
Houston, Texas 77339

From:

Copies:

☐ Owner

☐ Architect

☐ Consultant

Specification Section: Paragraph: Drawing Reference:
Detail:

Request:

Request By:
Date:

Response:

Response By:
Date:

Additional Information / Attachments:

☐ Samples ☐ Sketches

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 RELATED REQUIRMENTS: SEE CONSTRUCTION SCHEULES FOR SCHEDULING DOCUMENTS REQUIRED TO BE SUBMITTED WITH EACH REQUEST FOR PAYMENT.

1.02 TYPICAL PAYMENT REQUESTS

A. On the last day of each calendar month, submit to the Architect a Request for Payment covering work through the end of that month.
   1. Form: AIA Documents AIA G702, Application and Certificate for Payment; AIA G703, Continuation Sheet.
   2. Complete every entry on the form. Incomplete forms will be returned without action. Entries must match current Schedule of Values data. Subcontractor requisition values must be true and accurate.
   3. Sign and notarize the Request for Payment.
   4. Provide four 8 x 11 color photographs taken from 4 corners of the site each month. Include photographs with each monthly Application for Payment.
   5. Submit notarized Release of Lien for each previous month's Application for Payment.
   6. With each pay application, a summary of weather day
   7. With each pay application, an updated construction schedule shall be submitted, along with a description of any changes/updates to the previous approved schedule.

1.03 APPROVAL PROCUDURES

A. In taking action on the Contractor's Request for Payment, the Architect shall rely on the accuracy and completeness of the information furnished by the Contractor and shall not be deemed to represent that he has made audits of the supporting data.

B. Payment will not be made for materials and equipment stored off site, except at the Owner's discretion and prior to approval. When request for Payment includes material or equipment stored off site, the request shall be accompanied with a statement clarifying:
   1. Description of item.
   2. Location of bonded warehouse.
   3. Affidavit of Storage.
   4. Certificate of Insurance.
   5. Bill of Sale made to Owner stating there will be no additional costs for transportation and delivery.
   6. Statement certifying that item or any part thereof will not be installed in any construction other than Work under this Contract.

C. Materials stored on site must be identified and listed in stored materials column.

1.04 INITIAL PAYMENT REQUESTS

A. Submit a Schedule of Values at the Pre-construction Conference.

B. Provide at the Pre-construction Conference.
   1. Listing of Subcontractors and principal manufacturers, suppliers and fabricators.
   2. Progress Schedule.
   3. Schedule of Submittals.
   4. Listing of Contractor's staff assignments and principal consultants.
   5. Copies of acquired building permits and similar authorizations and licenses from governing authorities for current performance of the Work.
   6. Evidence satisfactory to Owner that Contractor's insurance coverages have been secured.
   7. Data needed to acquire Owner's insurance coverages.

1.05 FINAL REQUEST FOR PAYMENT

A. Before submitting request for final payment, perform final cleaning of the Work and forward to the Owner the bonds, written warranties required for particular items of Work and other documentation as follows:
   1. Properly executed releases or waivers of lien. Submit in duplicate prior to final payment. If the Contractor cannot finish a waiver of liens or releases satisfactory to the Owner, the Owner may require a surety bond as a condition precedent to final payment.
   2. Properly executed AIA Document AIA G707, Consent of Surety to Final Payment, 1994 Edition.
   3. Occupancy permits and similar approvals or certification by governing authorities.
   4. Testing/adjusting/balancing records, maintenance instructions, meter readings, start up performance reports, and similar changeover information germane to Owner's occupancy, use, operation, and maintenance of completed Work.
   5. Advice to Owner on coordination of shifting insurance coverages, including proof of extended coverages as required.
   6. Completion of project closeout requirements.
   7. Completions of items specified for completion beyond time of Substantial Completion.
   8. Transmittal of required construction records to Owner.
   9. Proof, satisfactory to Owner, that taxes, fees and similar obligations of Contractor have been paid.
   10. Removal of temporary facilities, services, surplus materials, rubbish etc.
   11. Changeover of locks and other Contractor access provisions to Owner's property.
   12. A copy of the punchlist, all items completed, and signed by Contractor will be required before final payment.

PART 2 PRODUCTS (NOT APPLICABLE TO THIS SECTION)

PART 3 EXECUTION (NOT APPLICABLE TO THIS SECTION)

END OF SECTION 01 29 00

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to coordination, administrative and supervisory personnel, general installation provisions, cleaning and protection.

1.02 COORDINATION

A. Coordination: Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation.
   1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
   2. Where availability of space is limited, coordination installation of different components and systems to assure maximum accessibility for required maintenance, service and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   5. Prepare similar memoranda for the Owner and separate contractors, if any, when coordination of their Work is required.

B. Administrative procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.
   2. Delivery and processing of submittals.
   3. Progress meetings.
   4. Project Closeout activities.

C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.03 SUBMITTALS

A. Staff Names: Within 10 days of Notice to proceed, submit a list of the Contractor’s principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
   1. Post copies of the list in the temporary field office, and at each temporary telephone.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer if each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer’s Instructions: Comply with Manufacturer’s installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in the Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work correctly positioned, aligned and true as intended by the Contract Documents, whether plumb, level, straight, sloped, or curved. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint width in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

F. Re-check measurements and dimensions before starting each installation.

G. Install each component during conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible materials as necessary to prevent deterioration.

H. Coordinate temporary enclosure with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, installed individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.02 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

END OF SECTION 01 31 00

SECTION 01 31 06
COORDINATION DRAWINGS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes administrative provisions for providing Coordination Drawings.

1.02 DESCRIPTION

A. Coordination Drawings: Reproducible overlay drawings showing work with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, conveying systems, fire suppression systems, plumbing systems, mechanical systems, electrical systems, lighting, fire alarm systems, telecommunications systems, electronic safety and security systems, and other services. Provide coordination drawings for work in the following:
   1. Under slabs-on-grade.
   2. In crawl spaces.
   3. In and above ceilings.
   4. In soffits and furr-downs.
   5. Within walls.
   6. Within chases.
   7. In mechanical spaces.
   8. In electrical spaces.

1.03 PROVISIONS AND USE OF ELECTRONICS

A. General: Electronic CAD files of the Contract Drawings will be furnished by Architect for Contractor's use in preparing Coordinating Drawings and Layout Drawings.

B. Release of electronic drawing files are conditional upon the following:
   1. The drawing represented in the CAD files are not Contract Documents.
   2. Files generally available for transfer will be limited to an impediments file as described in the Agreement.
   3. Only one set of electronic drawing files will be furnished; Contractor assumes responsibility for distributing pertinent files to the various subcontractors.
   4. The electronic drawing files have been developed without the assistance or specific expertise of the individual subcontractors and installers, and therefore do not account for or incorporate means, methods, shop standards, and routing economies required by individual subcontractors for the scope of work required by the finished Work.
   5. Modifications to the information and routings of the selected components shown on the electronic drawing files may be required and are the responsibility of the Contractor. All modifications are part of the scope of Work of this Project and shall be provided at no additional cost to Owner.
   6. Contractor and subcontractor agree that electronic drawing files are not fit for any particular purpose, including, but not limited to quantity take-offs, pricing, development of a building information model (BIM), clash detection, construction sequencing, or the manufacture of any building component or system.
   7. There are no assurances that the electronic drawing files will be usable by the Contractor's and subcontractor's systems, infrastructure, or software; and that the files may be subject to anomalies, errors, viruses, malware, or other unintended defects.

C. Limitations of Electronic Drawing File Transfer Agreement:
   1. Agreement Form applies to Architectural Drawings only. If Contractor desires electronic drawing files for Drawings prepared by one of Architect's consultants, Contractor may contact consultant directly to obtain such files.
   2. Contractor shall recognize that various consultants retained by the Architect for this Project, or retained separately by the Owner, may have agreements that differ from that

included in Appendix A, and may have differing costs and procedures involved with obtaining electronic drawing files.

3. Architect makes no assertion that the Architect's or Owner consultants will furnish electronic files of their Drawings. Additionally, not all Drawings may be available electronically.

1.04 INFORMATION SUBMITTALS

A. General: Submit in accordance with Section 01 31 00 - Project Management And Coordination.

B. Project Information:
   1. Contractor's stamped, approved Coordination Drawing.
      a. Letter indicating one copy of Coordination Drawing available at project site.
      b. One copy of approved coordination Drawings delivered to Architect for information and file.

C. Architect's Action: Refer to Section 01 33 00 - Submittal Procedures, for informational submittals.

1.05 QUALITY ASSURANCE

A. Prior to Start of Work: Require written approval of Coordination Drawings from each subcontractor whose work is contained within the scope of, or is affected by, the Work for which the Coordination Drawings have been prepared.

B. Coordination Meeting: Schedule with affected trades and subcontractors. Refer to Section 01 31 00 - Project Management And Coordination 01 31 00, Project Management and Coordination.

1.06 PRECEDENCE OF SERVICES FOR COORDIATION

A. In event of conflicts involving location and layout of work; use following priority to resolve disputes:
   1. Structure and partitions have highest priority.
   2. Equipment location and access.
   3. Ceiling system and recessed light fixtures.
   4. Gravity drainage lines.
   5. High pressure ductwork and devices.
   6. Large pipe mains, valves, and devices.
   7. Pneumatic tube and material conveying systems.
   8. Low pressure ductwork, diffusers, registers, grilles, HVAC equipment.
   9. Fire protection piping, devices, and heads.
   10. Small piping, tubing, electrical conduit, and devices.
   11. Sleeves through rated partitions.
   12. Access panels.
   13. Service Clearances.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PRODUCTION OF COORDINATION DRAWINGS

A. Provides minimum ¼ inch scale plan, elevation and section drawings, showing:
   1. Partitions
   2. Ceiling heights
   3. Structural framing locations and elevations.
   4. Column lines.
   5. Other impediments and interferences with installation of the Work.
   6. Locations of the various services and systems, horizontally dimensioned from column center lines, and vertically dimensioned from top of floor slab elevations.

7. All mechanical, electrical, plumbing and fire service components and systems including ductwork, piping, conduit, and fixtures.

B. Produce combined coordination layout drawing plans and sections that fully integrate the various fire suppression systems, plumbing systems, and HVAC systems.
   1. Systems shall be uniquely color-coded for ease of identification.

C. Prepare Coordination Drawings for coordination of installation of products and materials fabricated by separated entities.
   1. Indicate relationship of components shown on separate Shop Drawings.
   2. Indicate required installation sequences.
   3. Refer to Division 21 through 28 for specific Coordination Drawing requirements for facility services installations.

D. Resolve major interferences at initial coordination meeting prior to production of drawings.

E. Produce initial coordination drawings within time-frame required to manufacturer and install equipment and products to meet the Substantial Completion date.

F. Meet as required to resolve interferences and correct drawings.

3.02 PRODUCTION OF LAYOUT DRAWINGS

A. Provide scale plan and elevation drawings. Plans shall be prepared at a scale of 1/4 -inch per foot.

B. Indicate areas where access panels are required to gain access serviceable and maintenance items.

3.03 APPROVAL

A. After written approval of Coordination Drawings and Layout Drawings by each affected subcontractor, determine method used to resolve interferences not previously identified.

B. Give written approval of acceptable changes to Coordination Drawings and Layout Drawings prior to start of work in affected area.

C. Maintain one copy of current approved Coordination Drawings and Layout Drawings on Project Site.

3.04 ADJUSTING

A. At no additional cost to the Owner, make modifications required as a result of failure to resolve interference, provide correct Coordination Drawings and layout Drawings, or call attention to changes required in other work as a result of modifications.

END OF SECTION 01 31 06

DATE: _____

NAME: _____
COMPANY: _____
ADDRESS: _____
_____

PROJECT: _____

ELECTRONIC DRAWING FILE TRANSFER AGREEMENT FORM

At the *Contractor's* request, Architect, will provide electronic files for the *Contractor's* convenience and use in the preparation of shop drawings related to the above-referenced Project, subject to the following terms and conditions:

Architect makes no representation as to the compatibility of these files with the *Contractor's* hardware or software.

The electronic files are not Contract Documents. The undersigned *Contractor* acknowledges that the true and accurate record of the design is the most recent issued printed hard copy of the design, not the requested electronic data. In the event that a conflict arises between the *Architect's* signed and sealed hard-copy Contract Documents and the electronic files, the signed and sealed hard-copy Contract Document shall govern. *The Contractor* is responsible for determining if any conflict exists. The undersigned *Contractor* agrees to hold harmless and indemnify Architect and Architect's consultants from and against all claims, liabilities, losses, damages and costs, including but not limited to attorney's fees, arising out of or in any way connected with the modification, misinterpretation, misuse or reuse by others of the electronic information provided by Architect.

Data contained on these electronic files are part of the Architect's instruments of service and shall not be used by *the Contractor* or anyone else receiving these data through or from *the Contractor* for any purpose other than as a convenience in the preparation of shop drawings for the above-referenced Project. The use of these drawing files does not relieve *the Contractor* of any of the requirements or responsibilities for checking and coordination of the Work as described in the Contract Documents. When modified for project-related services, *the Contractor* shall add *Contractor's* company name, address, telephone number and contact information to the title block of each sheet. Because of the potential that the information presented on the electronic files can be modified, unintentionally or otherwise, Architect reserves the right to remove all indicia of ownership and/or involvement from each electronic display.

Architect will furnish the undersigned *Contractor* electronic files of the following Drawing sheets: (*Contractor to list drawings here*)

_____

_____

The electronic information will include only an impediments file (walls, doors, windows, millwork, columns, column grid and grid identifiers, room names, room numbers, drawing name and drawing scale). Legal disclaimers will be added to the files when required by state licensing authorities.

Under no circumstances shall delivery of the electronic files for use by the undersigned *Contractor* be deemed a sale by Architect, and Architect makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall Martinez Architects, LP be liable for any loss of profit or any consequential damages as a result of the *Contractor's* use or reuse of these electronic files.

All reports, plans, specifications, computer files, field data, notes and other documents and instruments prepared by the *Architect* as instruments of service shall remain the property of the *Architect*. The *Architect* shall retain all common law, statutory and other reserved rights, including the copyright thereto.

ACKNOWLEDGED AND ACCEPTED:
(The Contractor)

ARCHITECT
(The Architect)

_____ _____
Company

_____
Printed Name

_____
Printed Name of Recipient

_____
Signature

_____
Signature of Recipient

_____
Title

_____
Title

_____
Date

_____
Date

END OF AGREEMENT

SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Scheduling and holding or pre-construction, progress and pre-installation meetings throughout the progress of the Work to review the construction schedule, address pending problems, coordinating the work of various trades, and to allow Architect and Owner's representatives to ascertain whether the Work is consistent with the Contract Documents.

1.02 QUALITY ASSURANCE

A. Persons designed by the Contract to attend and participate in project meetings shall have all required authority to commit the Contractor to solutions as agreed upon in the project meetings.

1.03 SUBMITTALS

A. Duties of Contractor's Project Manager or representatives who schedules, prepares for and administers project meetings:
   1. Prepare agenda.
   2. Distributed written notice and agenda of Regular and Called Meetings seven (7) days in advance of meeting date.
   3. Make physical arrangements for meeting.
   4. Preside at meetings.
   5. Record minutes: Include significant proceedings and decisions.
   6. Distribute copies of minutes to participants, within four (4) days after meetings.
   7. Furnish one (1) copy of the meeting minutes to Architect.
   8. Furnish one (1) copy of minutes to Project Manager.
   9. Furnish one (1) copy of minutes to Owner's Representatives.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PRE-CONSTRUCTION MEETING

A. A pre-construction meeting will be held prior to commencement of the Work at a place and time to be announced by the Architect and/or Owner.

B. Agenda: Project coordination, administrative procedures, scheduling and other related subjects.

3.02 PROJECT PROGRESS MEETINGS

A. Coordination with the Architect and Owner's Representative as required to establish a mutually acceptable schedule for regular project progress meetings.

B. Attendance:
   1. Contractor's Contract Manager or his representative.
      a. Project Manager
      b. Project Superintendent
   2. Owner's Representative.
   3. Architect and Architect's consultants, if desired by Owner.
   4. Subcontractors as pertinent to agenda.
   5. Safety Representative (as required).

C. Minimum agenda:
   1. Approval of minutes of previous meetings.
   2. Review of Work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems which impede planned progress.
   5. Review of submittal schedule and status of submittals.
   6. Review of offsite 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.

D. Maintenance of quality and work standards.
1. Effect of proposed changes on progress schedule and coordination.
2. Other business relating to Work.

3.03 PRE-INSTALLATION MEETINGS

A. Where specified herein or when deemed appropriate by the Contractor, hold pre-installation meetings with members of the relevant trades involved to discuss installation of any specific building product, element, material or system.

B. As a minimum hold pre-installation meetings for following trades and system installation:
1. Site Clearing
2. Earthwork
3. Soil Stabilization

C. Site Utilities
1. Building and Site Concrete
2. Roughing-in of Plumbing and Electrical System Below Building Slab
3. Installation of Masonry
4. Erection of Metal Building System
5. Installation of Glazing and Glazed Systems
6. Installation of Lath and Plaster
7. Installation of Gypsum Wallboard
8. Installation Ceramic Tile
9. Installation of Acoustical Ceiling and Wall Panels
10. Installation of Resilient Flooring

D. Installation of Carpet
1. Painting and Staining
2. Roughing-in of MEP System above Ceiling

3.04 ATTENDANCE AT MEETINGS

A. To the maximum extent practicable, assign the same person or persons to represent the Contractor and Subcontractors at project meetings throughout the construction period.

END OF SECTION 01 31 19

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SUMMARY: PROVIDE BAR-CHART PROGRESS SCHEDULE, SCHEDULE OF VALUES AND SUBMITTAL SCHEDULE; PROJECT DIRECTORY; UPDATE AS SPECIFIED.

1.02 SUBMITTALS

A. Progress Schedule: Submit at Pre-construction Conference; schedule will establish interim completion dates for the various activities under the Contract.

B. Schedule of Values: Submit at Pre-construction Conference.

C. Submit actual Progress Schedule monthly along with each Request for Payment. Include any revisions to schedule due to executed Change Orders.

D. Submittal Schedule: Submit at Pre-construction Conference; will be used by the Architect to allocate time for review. Expeditions review of unscheduled submittals may not be possible; delays resulting will be the responsibility of the Contractor.

1.03 COORDIATION

A. Coordination the naming and sequence of activities for consistency between submitted reports or lists.
   1. Update at monthly or shorter time intervals to maintain coordination and correlation between separate reports.
   2. Distribution each updated report to entities involved in the Work including Architect and Owner.
   3. In particular, coordination Progress Schedule, Schedule of Values, listing of subcontractors, Submittal Schedule, progress reports, and payment requests.

1.04 QUALITY ASSURANCE

A. Architect Reliance upon Schedules: The Architect will rely upon revised schedules submitted with the Request for Payment as a basis for approving payment requests.

PART 2 PRODUCTS (NOT APPLICABLE TO THIS SECTION)

PART 3 EXECUTION

3.01 PROGRESS SCHEDULE

A. Prepare in the form of a bar chart with a separate horizontal bar for each trade or operation, and a horizontal time scale. Show the order and interdependence of all activities necessary to complete the Work. Include:
   1. Project mobilization.
   2. Submission and approval of submittals.
   3. Procurement of equipment and critical materials.
   4. Special fabrication, products and installation.
   5. Decision dates for selection of finishes and products specified by allowance or specified to be selected during the Sample review process.
   6. Final inspecting, testing and instruction.

B. Arrange schedule to show how sequence of Work is affected by requirements for phased completion, coordination with existing work, partial occupancy prior to Substantial Completion, site restrictions, provisions for future work and similar requirements of Project. All activities shall have a predecessor and a successor, with exception of the first and last items in the schedule. Baseline schedule shall be submitted within 30 days of Contract NTP, for review and approval. Baseline Schedule and Progress Schedule shall identify and display the following:
   1. Weather Days
   2. Milestones
   3. Critical Path

4. Logic
5. Float
6. Predecesors and Successors

C. Give Owner and Architect one week notice of anticipated significant requirements or Project.

D. Post 24”x36” original progress schedule in job trailer throughout construction.

3.02 SUBMITTAL SCHEDULE

A. Prepare a separate chronological schedule of submittals including the following:
1. Anticipated date of Architect’s receipt of submittal.
2. Required date of Architect’s return of submittal.
3. Specification sections to which submittal relates.
4. Subcontractor/supplier responsible for preparation.
5. Provide blank columns for actual date of submittal, resubmittal, and final disposition by Architect.

B. Give Architect two week notice of any anticipated significant revisions to approved Submittal Schedule. Allow approximately three weeks for the Architect’s review; however, this may vary depending on the quantity of the material submitted.

C. Correlate Submittal Schedule with listing of principle Subcontractor, as required by the General Conditions.

3.03 SCHEDULE OF VALUES

A. Prepare Schedule of Values, as required by General Conditions, in coordination with the preparation of the Progress Schedule. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of payment requests and progress reports.

B. Break down principal subcontractor amounts into separate labor and material items. Round off top nearest whole dollar, but with total equal to Contact Sum. Breakdown of Schedule of Values amounts must be true and accurate.

C. Where Work is separated into phases which require separately phased payments to Contractors, provide sub-schedules or values correlate with each phase.

D. Unit Cost Allowance: Show line item value as product of unit cost multiplied by the measured quantity as estimated from best indicated in Contract Documents.

E. Margins of Cost: Show line items of indirect costs and margins on actual costs only to extent such items will be individually listed in payments requests. In general, established each item in Schedule of Values (and in payment requests) to be completed with its total expenses and proportionate share of general share of general overhead and profit margin.

3.04 PROJECT DIRECTORY

A. Prepare, submit and update whenever necessary a Project Directory listing all entities involved in the Project with the names of their representative(s), addresses, telephone and fax numbers, and after hours/emergency telephone numbers. Submit copies to Owner, Architect and Architect’s consultants.

END OF SECTION 01 32 16

SECTION 01 32 23
SURVEY AND LAYOUT DATA

PART 1 GENERAL

1.01 QUALITY CONTROL

A. Conform to State of Texas laws for surveys requiring licensed surveyors. Employ a surveyor acceptable to Owner's Representative if required by the Contact.

1.02 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit name, address, and telephone number of Surveyor to Owner's Representatives before starting survey work.

C. Submit documentation verifying accuracy of survey work on request.

D. Submit certificate signed by Surveyor, that elevations and locations of the Work are in conformance with the Contractor.

1.03 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. Prepare a certified survey setting forth dimensions, locations, angles, and elevations of construction and site work upon completion of foundation walls and major site improvements.

C. Submit record documents under provisions of Division 1.

1.04 EXAMINATION

A. Verify locations of survey control points prior to starting the Work.

B. Notify Owner's Representatives immediately if any discrepancies are discovered.

1.05 SURVEY REFERENCE POINTS

A. The Owner will establish survey control datum as indicated on Drawings. Infor Owner's Representatives in advance of time additional horizonal and vertical control points will be established so verification deemed necessary by Owner's Representative may be done with minimum inconvenience to the Owner or Contractor.

B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

C. Notify Owner's Representative a minimum of 48 hours before relocation of reference points is needed due to changes in grades or other reasons.

D. Promptly report loss or destruction or reference points to Owner's Representative.

E. Reimburse the Owner for cost of reestablishment of permanent reference points disturbed by construction operations.

1.06 SURVEY REQUIREMNTS

A. Utilize recognized engineering survey practices.

B. Established a minimum of two permanent benchmarks on site, referenced to established control points. Record horizontal and vertical location data on Project record documents.

C. Established elevations, lines and levels to provide quantities required for measurement and payment and for appropriate controls for the Work. Locate and lay out the following with appropriate instruments:
   1. Site improvements including grading, fill and topsoil placement, utilities, and footings and slabs.
   2. Grid or axis for structures.
   3. Building foundation, column locations, and ground floor elevation.

D. Periodically verify layouts.

1.07 AS-BUILT SURVEY REQUIREMENTS

A. Detention Ponds:
   1. If a detention pond is included in scope of work, Contractor shall provide Owner and Engineer an As-Built survey of said detention pond for volume verification prior to seeding/sodding or covering pond. Contractor shall provide two hard copies and one AutoCAD file with points.
   2. For open ponds, survey shall include enough information for Engineering to perform volume verification calculations. Items shall include but not be limited to: top of bank delineation and elevations, toe of slope delineation and elevations, pilot channels (or center swale) and elevations, and inflow/outflow structures. Survey grid shall be 50' maximum. Survey shall extend a minimum of 20' outside top of bank of pond.
   3. For below grade (underground) ponds, survey shall include but not be limited to: layout of below grade structure including pipe sizes, box culvert sizes, etc. and flowlines of structure.
   4. As-Built survey shall be signed and sealed by a registered Land Surveyor.

B. Sites located in the 100-year Floodplain:
   1. Sites located in the 100-year Floodplain will require an As-Built Certificate. Contractor shall provide Owner and Engineered an As-Built Survey (2 hard copies) of completed site for use in filling out said As-Built Certificate. Survey shall include but is not limited to: finished floor elevation(s) of all slabs (including recessed interior slabs, raised interior slabs and bottom or elevator pits), paving elevations, outside mechanical equipment elevations (A/C units, chillers, compressors, etc.) and all fill placed within 100-year Floodplain. Survey shall include entire site.
   2. Contractor shall coordinate with Engineer for exact Governmental requirements prior to survey.
   3. As-Built survey shall be signed and sealed by a registered Land Surveyor.

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION 01 32 23

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 RESPONSIBILITY: SUBMIT ONLY THROUGH THE CONTRACTOR, WHO SHALL DELIVER SUBMITTALS ELECTRONICALLY TO THE OFFICE OF THE ARCHITECT OR ENGINEER. BEAR AND PREPAY ALL SOFTWARE COSTS, SUBSCRIPTIONS, REPRODUCTION, PACKAGING, HANDLING, POSTAGE AND DELIVERY COSTS FOR SUBMITTALS. ELECTRONIC TRACKING AND MANAGEMENT SYSTEM CAPABLE OF STORING AND DISPLAYING A SUBMITTAL LOG AND ALL PROJECT SUBMITTALS. THE SUBMITTAL LOG AND ALL SUBMITTAL INFORMATION MUST BE PRINTABLE AND CONTINUOUSLY ACCESSIBLE VIA INTERNET BY THE GENERAL PRIME CONTRACTOR, SUBCONTRACTORS, SUPPLIERS, ARCHITECT, ENGINEER AND OWNER. ACCESSIBILITY WILL BE PASSWORD CONTROLLED PERMISSIONS. PROVIDE UPLOADING AND EDITING CAPABILITIES FOR THE GENERAL PRIME CONTRACTOR, ARCHITECT AND OWNER.

1.02 USE: MAINTAIN LICENSES THROUGH THE DURATION OF THE PROJECT FOR THE OWNER, ARCHITECT AND THEIR REPRESENTATIVES. USE ONLY SUBMITTALS MARKED "NO EXCEPTION TAKEN" OR "EXCEPTIONS NOTED" BY THE ARCHITECT FOR CONSTRUCTION.

PART 2 PRODUCTS

2.01 SUBMITTAL MANAGEMENT SYSTEM

A. Procore Construction Management System

PART 3 EXECUTION

3.01 SUBMITTAL PROCEDURES

A. Before submittal to Architect, review submittals for conformance to Contract Documents. Apply Contractor's approval stamp and information as specified below. Submittals not reviewed for compliance by General Contractor will not be reviewed by Architect.

B. Shop Drawings: Prepare and submit to the Architect reviewed shop drawings. Architect will review and return to the Contractor.

C. Product Data: Submit descriptive literature, brochures, test reports, schedules, installation instructions, warranties and other standard printed Product Data, and certification letters.

D. Samples: Unless additional samples or sets of samples are requested by Architect, submit in duplicate. Include information, review and approved required for submittals on accompanying letter of transmittal, and where practicable identify samples fully on labels placed on the back or in an inconspicuous location, including at least the Project name and Architect's Project number, sample source, submittal number and applicable specification section number.

E. Resubmittals: Submit in the same form. Note previous submittal's date and submission number for this item of work on resubmittals.

F. Allow fifteen working days for processing and review of any one submittal. Each review period shall begin on date of receipt of submittal by the Architect and extend to date of mailing or transmission to Contractor.

G. Copies of Contract Drawing are not acceptable as Shop Drawings, unless authorized in writing by the Architect.

H. Furnish all final Shop Drawings and Product Data required by authorities having jurisdiction, by Subcontractors and suppliers for coordination of work, and by other contractors whose work is related.

I. Coordinate submittals into logical grouping to facilitate interrelation of associated items.

3.02 SHOP DRAWINGS, PRODUCT DATA & SAMPLES – INFORMATION REQUIRED

A. Illustrate fully requirements of the Contract Documents, and identify products, materials and equipment. Show methods of support and assembly, dimensions, joints, connections and all other data required for fabrication, coordination and installation. Clearly indicate the relationship to adjoining work, indicating, where appropriate, field measured dimensions.

B. For physical samples, permanently label each submittal with the following:
   1. Name of Project.
   2. Name or Contractor.
   3. Name of Subcontractor, Manufacturer or Supplier.
   4. Number and title of relevant Section, drawing or detail.
   5. Drawing number and detail references.
   6. Locations products are to be installed, as appropriate.
   7. Where printed materials described more than one product or model, clearly identify the item to be furnished.
   8. Show previous applicable changes made in the Project by Change Orders and other instructions or remarks.

C. For electronic transmittal, stating the following information:
   1. Contractor’s name and signature of representative.
   2. Project name.

D. List of submittal titles and number of copies.
   1. Date of submission.
   2. Submission number. Number transmittals consecutively.
   3. Specification Division of submittal.

E. In addition to the information required in B and C above, resubmittal Shop Drawings and Product Data shall bear the date and notation of revision in the title block and shall indicate extent of revisions clearly “bubbled” or “clouded”.

F. Note substitutions or deviations form contract requirements in a conspicuous manner.

G. Do not make changes on returned to the Contractor with Architect’s stamp applied.

H. Submit Product Data prior to or with material samples.

3.03 CONTRACTOR’S REVIEW OF SHOP DRAWINGS AND PRODUCT DATA

A. Prepare a stamp for Contractor’s review of submittals which bears the Contractor’s name and the following information:
   1. CONTRACTOR'S NAME
   2. PROJECT NAME
      a. This Submittal:
      b. ( ) Conforms to Contract Documents
      c. ( ) Confronts to Contract as noted
      d. ( ) Deviates from Contract requirements; substitutions noted
      e. Supplier or
      f. Subcontractor: _____
      g. Contractor
      h. Review by: _____ Submittal#: _____
      i. Spec. Date Return
      j. Sect.#: _____ Submitted: _____ By: _____

B. Architect will not review submittals not bearing this stamp and signatures evidencing Contractor’s review/coordination.

C. Prior to each submittal, carefully review and coordination all aspects of each item being submitted and verify that each item and its submittal conforms in all respects to the Contract

requirements. By stamping, marking and signing each submittal, Contractor certifies that this coordination has been performed.

3.04 ARCHITECT'S REVIEW PROCEDURES

A. Review by the Architect shall not be construed as a complete check, but only that the general method of construction and detailing is satisfactory. Review shall not relieve the Contractor from responsibility for errors.

B. "No Exception taken" and "Exceptions Noted" notations authorize the Contractor to proceed with fabrication, purchase, or both, of the items so noted, subject to the revisions, if any, required by Architect's review comments.

C. If change of a substantial nature is necessary in the submittal, or a portion of the submittal is unacceptable, but fabrication on the remaining portions of products shown in the submittal can proceed in accordance with the corrections noted by the Architect, the submittal may be returned to the Contractor bearing the stamp of the Architect: "Revise and Resubmit". The Contractor may proceed with fabrication on all acceptable portions of the submittal in accordance with corrections noted by the Architect. The Contractor shall correct and resubmit the part of the submittal in question. The Architect will indicate which portion of the submittal is unacceptable.

D. If a submittal is returned to the Contractor with the Architect's stamp marked "Submit specified item", purchase and/or fabrication of the work shown cannot proceed. Correct the submittal and resubmit.

E. The Architect's review of submittals shall not be construed as authorized any change in the Contract Sum or Contract Time unless so stated in a separate Bulletin, nor shall it be construed as relieving the Contractor of responsibility for coordination of Work with other trades, or interpretated as approval of quantities and dimensions.

F. Architect's review shall not relieve the Contractor from responsibility for furnishing Work required by the Contract Documents that may been omitted on the shop drawings. Architect's review of a separate item shall not be indicated review of the complete assembly in which it functions.

G. Contractor shall make corrections in submittals required by Architect and resubmit until released for fabrication. Show each drawing revision directed by number, date and subject in a revision block on the drawing. Make only those revisions directed or approved by the Architect, clearly indicating them as required above.

H. If Contractor considers any revision a change, he shall so notify Architect; see MODIFICATION PROCEDURES.

I. When submittals have been reviewed by the Architect, resubmittal for substitution will not be considered unless accompanied by an explanation acceptable to the Architect of why the substitution is considered necessary.

J. Resubmittals of previously approved shop drawings will not be reviewed.

3.05 SAMPLES

A. Unless colors and patterns are specifically identified in the Contract Documents, whenever a choice of color or pattern is available, submit accurate color pattern charts or samples to the Architect for selection.
   1. Where Contract Documents specifically schedule or otherwise indicate particular colors or patterns, submit the sample in the colors or patterns so required.
   2. Where custom colors are specified without being identified, submit proposed color for approval.

B. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures and patterns for Architect's selection and approval by Owner's representative.

C. Reviewed samples which may be used in the Work are indicated in the individual Specification sections.

D. Label each sample with identification required for transmittal letters.

E. Where possible, provide samples that are physically identical with the proposed material or product to be incorporated in the work.

F. Mockups: Provide full-sized sample installations where directed by Architect; re-work, re-install or otherwise correct until acceptable to Architect. Accepted mock-ups shall serve as a standard for judging the quality of the workmanship in the finished Work. Maintain mock-ups until all such work is accepted; remove upon Project completion.

3.06 CERTIFICATES OF COMPLIANCE

A. When required, submit notarized certification that all materials used in the Work comply with all specified provisions thereof. Certification shall not be construed as relieving the Contractor from furnishing satisfactory materials if, after tests are performed on sealed sample, the material is found not to meet specified requirements.

3.07 CLOSEOUT DOCUMENTATION

A. Prior to project closeout, submit a complete set of electronic files including all submittals and submittal log in PDF format on removable storage device.

END OF SECTION 01 33 00

SECTION 01 35 16
ALTERATION PROJECT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes:
   1. Products and installations for patching and extending Work within construction areas of existing facilities, site amenities and Owner temporary.
   2. Provide transition and adjustment.
   3. Repair of damaged surfaces and finishes.

B. Related Sections include the following:
   1. Section 01 50 00 - Temporary Facilities And Controls
   2. Section 02 41 91 Selective Structural Demolition

1.02 OCCUPANCY, ACCESS, AND PROTECTION

A. Normal business hours for facility are generally from 8:00 a.m. through 5:00 p.m., Monday through Friday.

B. Cooperate with Owner in scheduling operations to minimize conflict and to permit continuous usage. Perform work not to interfere with operations of occupied areas.

1.03 SCHEDULING OF WORK

A. Make arrangements with Owner and schedule Work to avoid interference with normal operations of occupied areas. Submit schedule and summary of applicable Work within occupied areas and obtain Owner approval not less than two days prior to commencement of such Work.
   1. Requests for use of certain existing loading zones, passage ways, and other similar spaces within areas outside limits of construction operations will be limited to day-to-day basis and must be approved in advance by Owner.

B. Coordinate access and scheduling of Work within tenant areas with Owner.

1.04 TORCH-CUTTING AND WELDING PROCEDURES

A. Notify Owner in advance of torch-cutting and welding operations performed within occupied areas; obtain approval prior to proceeding with such operations.
   1. Neither open-flame torch-cutting, welding nor arc-welding are allowed without having secured appropriate permit from Fire Marshall or authority having jurisdiction.
   2. Keep portable fire extinguisher of appropriate class within reach during welding or torch-cutting operations.
   3. Screen arc-welding from vision of passersby.

B. Maintain a “Fire Watch” for minimum of 60 minutes after completion of each torch-cutting and welding operation.

1.05 UTILITY SERVICE OUTAGES

A. Keep utility and service outages to minimum and perform only after written approval of Owner is received.
   1. Requests for outages will not be considered unless they include an identification of areas which will be affected by proposed outage.
   2. Schedule outages for times other than normal business hours.
   3. Make requests for outages minimum of five calendar days in advance of proposed outage. Request may be denied or postponed due to scheduled activities.

B. Contractor: Responsible for investigating utility and service lines to determine effect of outage upon building operations outside of limit of operations. Obtain approval in advance from Owner to execute investigations.

1.06 KEYS

A. When necessary to perform Work, Owner will issue keys existing mechanical/electrical equipment spaces.

B. Return keys at end of each work day; request keys on succeeding days, if necessary.

PART 2 PRODUCTS

2.01 MATERIALS

A. Type and Quality of Existing Products: Use products or types of construction that exist in structure, as needed to patch, extend, or match existing Work.
   1. Generally, Contract Documents do not define products or standards of workmanship present in existing construction.
   2. Determine by inspecting and testing products where necessary, referring to existing work as qualified standard.

B. New Materials: Comply with Specifications for each product involved.
   1. Match existing products and work for patching existing work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Comply with provisions of Section 01 72 00 - Common Execution Requirements.
   1. Verify that areas are ready for alteration and remodeling.

B. Discrepancies: Verify dimensions and elevations indicating in layout of existing work.
   1. Prior to commencing work, carefully compare and check Contract Documents for discrepancies in locations or elevations of work to be executed.
   2. Refer discrepancies in locations among Drawings and existing conditions to Architect for adjustment before work affected is performed.

3.02 PREPARATION

A. Cut, move, or remove items as necessary for access to alteration and renovation Work.
   1. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, deteriorated masonry and concrete, and other deteriorated materials. Replace materials as specified for finished Work.
   2. Remove debris and abandoned items from area and from concealed spaces.

B. Cutting and Removal: Perform cutting and removal work to remove minimum necessary, and in manner to avoid damage to adjacent work. Cut finish surfaces such as masonry, tile, plaster, or metals by methods to terminate surfaces in straight line at natural point of division.

C. Prepare surface and remove surface finishes as necessary to provide for proper installation of new materials and finishes.

D. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

E. Provide temporary barriers and closures to control operations to prevent spread of dust to occupied portions of building; refer to Section 01 50 00, Temporary Facilities and Controls.

3.03 INSTALLATION

A. Coordinate Work of alterations and renovations to expedite completion and to accommodate Owner occupancy.

B. Remove, cut, and patch Work in manner to minimize damage and to provide means of restoring products and finishes to specified condition.
   1. Refinish visible existing surfaces to remain to specified condition with neat transition to adjacent finishes.

C. Install products as specified in individual Specification sections.

D. Where new Work abuts or aligns with existing, perform smooth and even transitions to match existing adjacent surface in texture and appearance.
   1. When finished surfaces are cut so that smooth transitions with new Work is not possible, terminate existing surface along straight line at natural line of division and request instructions form Architect as to method of making transition.

3.04 ADJUSTMENTS

A. Fit Work at penetrations of surfaces as specified in Sections 01 73 29 - Cutting And Patching.

B. Patch or replace portions of existing surfaces which are damaged, lifted, discolored, or showing other imperfections. Repair substrate prior to application of finishes.

3.05 FINISHES

A. Finish new surfaces as specified in individual Specification sections.

B. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

3.06 CLEANING

A. Comply with Section 01 72 00 - Common Execution Requirements. Thoroughly clean areas and spaces affected by Work. Completely remove paint, mortar, oils, putty and items of similar nature.

B. Clean Owner-occupied areas daily. Clean spillage, overspray, and heavy collection of dust in Owner-occupied areas immediately.

C. Refer to drawings for dust control requirements between construction area and adjacent spaces.

END OF SECTION 01 35 16

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 GOVERNING LAWS, CODES AND STANDARDS

A. Contractor shall become fully informed of the requirements of all federal, state, and local laws, codes, regulations, ordinances and authorities having jurisdiction relating to the construction and shall comply with them, including but not limited to the following:
   1. Building Code: International Building Code (IBC), current adopted edition.
   2. Texas Accessibility Standards (TAS), latest edition.

B. Applicable published standards of specifications of government agencies, technical associations, trade association, or other organizations are referenced herein. Work so referenced shall conform to or surpass the minimum standards of quality for materials and workmanship established by the designated standard or specification.

C. Standards referenced directly in the Contract Documents or by governing regulations have precedence over non-referenced standards which are recognized in the industry for applicability to the Work. Non-referenced standards recognized in the construction industry have direct applicability to the Work where not in conflict with standards which have precedence.

D. The latest edition and amendments adopted, published and available to the public on the date of this Project Manual for any referenced standard shall apply.

E. Where two or more standards are specified to establish quality, the product and workmanship shall conform to or surpass the requirements of both.

F. Where both a standard and a brand name are specified for a product in the Project Manual, the proprietary product names shall conform to or surpass the requirements of the specified reference standard. The listing of trade name in the Project Manual shall not be constructed as warranting that such product to the respective reference standard, or that the product is available.

G. In case of conflict between reference standards, when more than one standard or code is cited, and these standards establish different of conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents specifically indicate a less stringent requirement. Refer to the Architect for a decision before proceeding if uncertainties about requirements exist.

H. Where copies of referenced standards are needed for proper performance of the Work, the Contractor is required to obtain such copies directly from the publication source.

I. Refer to Section 01 42 00 - Definitions And Abbreviationsfor a list of construction terms, industry organizations and government agencies to which reference may be made by abbreviations in the Project Manual and other Contract Documents.

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION 01 41 00

SECTION 01 42 00
DEFINITIONS AND ABBREVIATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Definitions of terms and abbreviations, and explanation of the organization, interpretation and use of the Drawings, Specifications and associated Contract Documents.

1.02 TERMINOLOGY

A. The following terms shall be understood as herein defined, as applicable in the context, unless the context clearly indicates otherwise.
   1. Architect: Martinez Architects, LP, or its designated representative(s).
   2. Owner: Hays County ESD #4, Texas, or its designated representative(s).
   3. Product: Includes materials, equipment and systems.
   4. Furnish: To supply and deliver to the job site, ready for unpacking, assembly and installation.
   5. Install, Installation, etc.: Refer to operations at the project site, including handling, storage, unpacking, assembly, erection, placing, anchoring, applying, connection, working to dimension, finishing, curing, application and similar operations.
   6. Installer: The entity (person and firm) engaged by Contractor, or its subcontractor or subsubcontractor, for performances of a particular unit of work at the site, including installation, erection, application, and similar operations. Such entities (“Installers”) must be experienced and expert in the operations they are engaged to perform.
   7. Provide: To furnish and install, complete and ready for the intended use.
   8. Suitable, reasonable, proper, correct, necessary, etc.: Such terms shall mean suitable, reasonable, proper, correct, or necessary for the purpose intended as required by the contract documents, in the judgement of the Architect.
   9. Including, such as: Always to be understood in the most inclusive sense, namely, “including, but not limited to”, and “such as, but not limited to”.
   10. Indicated: A reference to information found elsewhere in the Contract Documents, including information in the project Manual, schedules, drawings, details or notes.
   11. Shown, noted, scheduled, detailed: Also used for references to information shown on drawings and in schedules. These terms and the word “indicated” are used for the purpose of helping the reader locate the reference; no limitation of location is intended unless specifically stated.
   12. Exposed: Any item or surface, exterior or interior, which can be seen by a person outside the building, or a person inside any usable space within the building during normal activity.
   13. Remove: Where not applicable to salvage, retained materials, materials to be re-installed or relocated or otherwise qualified, means or disassemble, dismantle or demolish and transport from Owner’s property.
   14. Punch List: A comprehensive list of items to be completed or corrected.

1.03 DRAWING INTERPRETATION

A. Product notes on the drawings are for identification of materials.

B. Sections and details show typical products and assemblies. Provide completely materials which are vignetted or only partially shown to avoid repetition. Each product indicated or drawings shall be continuous throughout all parts of the project where the section of the detail applies.

C. Provide related products and suitable workmanship at corners and intersections necessary for structural integrity, weathertightness and continuity of appearance.

D. Only major attachments and accessories are indicated in the drawings and specified in the Project Manual. Provide all anchors, bolts, screws, nails, adhesives and other fastenings necessary to produce a firmly fastened, smoothly functioning, weathertight, secure and neat installation.

E. Larger scale drawings generally take precedence over smaller scale.

F. Use numerical dimensions indicated. Do not scale drawings. Check figures on drawings before stating the work affected.

G. If necessary dimensions or figures are inadvertently omitted or conflict with other dimensions, drawings or specifications, notify the Architect. Do not proceed with the work without correct and definite information provided by the Architect in writing.

1.04 PROJECT MANUAL INTERPRETATION

A. Section titles do not limit the content, scope or meaning of the section, nor is it fully descriptive of the requirements specified therein.

B. Each section of the specifications has been subdivided into parts for uniformity and convenience. These parts and the titles of these parts do not limit the requirements of the text.

C. The work specified in any one Section is related to and dependent upon the work specified in other sections. Work specified in all Sections is governed by the terms of the Contract and provisions of the General Conditions, Supplementary Conditions and Divisions 1 General Requirements.

D. The cross-reference paragraphs Related Requirements etc. are general items included for the convenience of Project Manual users and shall not be considered all-inclusive in any case.

E. Cross referencing to other Sections may be made by inclusion of the section title in capital letters without a preceding word section or section number (e.g. See UNIT MASONRY).

F. Imperative Language: Used generally; except as otherwise indicated, requirements expressed imperatively are to be performed by Contractor. For clarity of reading at certain locations, contrasting indicative language is used to describe responsibilities to be fulfilled indirectly by Contractor, or when so indicated, by others.

G. If requirements of the Contract Documents are unclear or conflict with each other, and if conditions indicated in the Contract Documents do not reflect accurately the conditions found to exist at the site, request and receive clarification, interpretation or further instruction from the Architect before proceeding with the affected work.

1.05 ABBREVIATIONS

A. Following is a list of construction terms, industry organizations and government agencies to which reference may be made by abbreviations in the Project Manual and other Contract Documents.

AAMA American Architectural Manufacturers' Association
ACI American Concrete Institute
ACIL American Council of Independent Laboratories
AIA American Institute of Architects
AISC American Institute of Steel Construction
AISI American Iron and Steel Institute
AMCA Air Movement and Control Association
ANSI American National Standards Institute
APA American Plywood Association
ARI Air Conditioning and Refrigeration Institute
ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME American Society of Mechanical Engineers
ASTM American Society for Testing and Materials
AWI Architectural Woodwork Institute
AWPA American Wood Preserves Association
AWPB American Wood Preserves Bureau
AWPI American Wood Preserves Institute
AWS American Welding Society
BIA Brick Institute of America

BHMA Builder's Hardware Manufacturers Association
CDA Copper Development Association
CRSI Concrete Reinforcing Steel Institute
CSI Construction Specifications Institute
DHI Door Hardware Institute
EPA Environmental Protection Agency
FGMA Flat Glass Marketing Association
FM Factory Mutual
GA Gypsum Association
MIL Military Standard
NAAMM National Association of Architectural Metal Manufacturers
NCMA National Concrete Masonry Association
NEC National Electrical Code (Published by NFPA)
NEMA National Electrical Manufacturers Association
NFBU National Board of Fire Underwriters
NFPA National Fire Protection Association
NIST National Institute of Standards & Technology (formerly National Bureau of Standards)
NRCA National Roofing Contractors' Association
NRMCA National Ready Mix Concrete Association
NWMA National Woodwork Manufacturers' Association
OSHA Occupational Safety and Health Administration (U.S. Department of Labor)
PCA Portland Cement Association
PCI Prestressed Concrete Institute
PS Product Standard of NIST (U.S. Department of Commerce)
SDI Steel Door Institute
SFPA Southern Forest Products Association
SPIB Southern Pine Inspection Bureau
SMACNA Sheet Metal and Air Conditioning Contractors National Association
SSPC Steel Structures Painting Council
TCA Tile Council of America
UL Underwriters' Laboratories
WWPA Western Wood Products Association

PART 2 NOT USED

PART 3 NOT USED

END OF SECTION 01 42 00

SECTION 01 43 00
INSPECTION AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 DESCRIPTION

A. Inspection and testing laboratory services will be provided and paid for by Owner. An inspection and testing lab will be selected by the Owner and the Contractor will be notified as soon as possible.

B. The Owner will pay for the initial inspection and testing laboratory services of materials that comply with the requirements of the Contract Documents. The Contractor shall pay for re-inspection and re-testing of materials that do not comply with the requirements of the Contract Documents.

C. The Contractor shall cooperate with the inspection and testing laboratory in all matters pertaining to the work. The Owner retains the options to add to or delete any or all inspection and testing specified herein.

1.02 RELATED REQUIREMENTS

A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals or public authorities.

B. Respective Sections of Specifications. Certified Products.

C. Each Specification Section Listed: Inspection and laboratory test required and standards for inspection and testing.

D. Testing laboratory inspection, sampling and testing are required for, but not limited to the following:

1.03 REFERENCE STANDARDS

A. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2026a.

B. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2026a.

C. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2026.

D. ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete; 2024a.

E. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026.

F. ASTM C143/C143M - Standard Test Method for Slump of Concrete; 2026a.

G. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2026.

H. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2025a.

I. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2026.

J. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

K. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2017, with Editorial Revision (2018).

L. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 2019 (Reapproved 2023).

M. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2019 (Reapproved 2023).

N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).
   1. Division 2: All Sections regarding earthwork and related work.
   2. Section 03 30 00 – Cast-In-Place Concrete
   3. Section 03 32 10 – Lightweight Insulating Concrete Deck System
   4. Section 04 20 00 – Unit Masonry

O. Section 05 12 23 – Structure Steel
   1. Division 7: Roofing Sections and related work.
   2. Division 22-33 – Earthwork (Compaction of trenches)
   3. Division 23 – HVAC (Inspection and testing of welds and bolts on mechanical piping)
   4. Section 31 63 29 – Drill Concrete Piers and Shafts
   5. As requested by the Owner, Architect, or Engineer.

1.04 AUTHORITIES AND DUTIES OF THE LABORATORY

A. The inspection and testing laboratories is not authorized to revoke, alter, relax, enlarge, or release any requirements of the Specifications, or to approve or accept any portion of the Work. When it appears that the material furnished or work performed by the Contractor fails to fulfill specification requirements, the inspection and testing laboratory shall promptly notify the General Contractor, Architect, Engineers, supplier and/or subcontractor providing or preparing the materials or work being tested of such deficiencies.

B. The inspection and testing laboratory shall promptly distribute copies of the laboratory test and inspection reports. Standard distribution shall include copies of all reports to the Owner, Architect, and General Contractor. The Structural Engineer, Civil Engineer, MEP Engineer, concrete supplier, and any outside consultants shall receive copies of the testing results regarding their particular phase of the Project.

1.05 TESTING LABORATORY GUIDELINES AND PROCEDURES

A. Technicians scheduled to perform specific inspection and testing services must be qualified to review and perform other services that overlap, i.e. earthwork, foundation inspections, rebar inspection, and concrete when scheduled concurrently at the Project site.

B. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for any hours over eight (8) hours spent at the job site on a single day, field testing services performed on a Saturday or Sunday, and any field services performed on a recognized holiday.

C. Concrete design mixes will receive a cursory review with any discrepancies reported to the Architect/Engineer.

D. Nuclear density testing will be based on a daily rental rate for the actual testing equipment, compensation on a per test basis will not be considered.

E. Report distribution shall include the Owner, Architect, Contractor, Civil Engineer, Structural Engineer, and others requesting or requiring review of the specific testing results.

F. There will be a three (3) hour minimum for each schedule testing service. Vehicle charges will be included on a per trip basis.

G. Cylinders will be pick-up by the technician performing test the next day in order to have them cure under laboratory conditions.

H. Structural steel inspection shall include a plant visit reviewing shop fabrication, welding and an overall review of the shop fabrication quality control standards.

I. The Contractor shall bear the responsibility of scheduling all of the inspection and testing services. The Contractor and the testing laboratory shall assume full responsibility to coordinate the inspection and testing services. Cancellations and or failed test will be reimbursable to the Owner by the Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. Inspection and testing services shall include, but not be limited to those specified below or which are necessary or required during course of construction to ascertain specification compliance and which may be deemed necessary by Architect, Engineer, or Owner to ensure the quality of the Work.

B. Where requirements of this Section are in conflict with requirements noted on the Contract Drawings or other Sections of the Specifications, the more stringent requirement shall apply, unless directed otherwise by Architect.

C. Should any unusual conditions be encountered during any operations, the laboratory shall be contacted immediately so that additional inspection and testing, as applicable, can be provided.

D. The Owner reserves the right to add to or delete any or all inspection and testing specified herein.

3.02 SITE GRADING

A. Testing Services:
   1. Perform field tests for moisture density properties.
      a. In each compacted fill layer, provide one (1) field test for every 5,000 sq feet (5.38213 sq cm) of area, but not less than three (3) tests.
      b. At paved area, provide one (1) field test for every 5,000 sq feet (5.38213 sq cm), but not less than three (3) tests.

3.03 COMPACTING FILL AND BACKFILL

A. Testing Services:
   1. Perform field test for more moisture density properties: Within the building line provide one (1) field test in each compacted layer for every 5,000 sq feet (5.38213 sq cm) of area, but not less than three (3) tests.

3.04 PAVING

A. Testing Services:
   1. Perform field tests for moisture density properties:
      a. Provide field testing of the sub-grade as described in Paragraph 3.02, A, above.
      b. Paving sub-base, provide one (1) field test for every 5,000 sq feet (5.38213 sq cm) of crushed limestone or caliche sub-base, if any.
   2. Lime treated sub-grade, provide one (1) field test for every 5,000 sq feet (5.38213 sq cm) of area of lime treated sub-grade, if any, for content of lime and sub-grade compaction.
      a. Cement soil stabilization, if any, provide one (1) field test for every 5,000 sq feet (5.38213 sq cm) of area of cement stabilization sub-grade for content of cement and sub-grade compaction.

3.05 PIPED SITE UTILITIES

A. Inspection and Observation Services:
   1. Inspection of trenches for proper alignment and grade.
   2. Inspection of pipe bedding and supports.
   3. Inspection of pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
   4. Inspection of installation of pipe and joints.
   5. Observations of testing of piped utilities performed by Contractor.

3.06 EARTHWORK

A. Inspection and Observation Services:
   1. Refer to and include, as applicable, work of Paragraphs 3.02, 3.03, 3.04, and 3.05 above.

2. When perimeter and underfloor drainage systems are specified or required, inspect installation of such systems for conformance with specified materials and detail requirements.
3. When temporary drainage and dewatering systems are used to keep excavations dry, inspect the systems for adequacy. Ground water should be maintained at least two (2) feet below bottom of excavation.
4. Review the equipment and methods used in placement and compaction of fill materials and inspect materials used and compaction of fills in general earthwork and in backfilling around structures, and in backfilling in utility trenches.
5. Notify the Contractor in writing and the Architect immediately if footings and slabs-on-grade are placed on unfinished soil or frozen ground and when footings and slabs-on-grade are not protected from frost damage.
6. Notify the Architect when soil with allowed bearing capacity noted is encountered at elevation above the bottom of footing shown.
7. Notify the Architect and Contractor if soil with required bearing capacity noted is not encountered at bottom of footing elevation shown. Bottom of footing shall be adjusted as recommended and approved by the Structural Engineer and Architect.
8. Review rock excavation techniques, if required, and monitor blasting induced ground motions, as appropriate.
9. Review calculations and shop drawings for sheeting, shoring, and underpinning prepared by the Contractor, if required.

B. Testing Services:
   1. References (As applicable for tests):
      a. ASTM International (ASTM)
         1) ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3 (600 kN-m/m3)
         2) D2922, Standard Test Method for Density of Soil and Soil-Aggregate In Place By Nuclear Methods (Shallow Depth)
         3) ASTM D4318, Liquid Limit, Plastic Limit, and Plasticity Index of Soils
      b. American Association of State Highway and Transportation Officials (AASHTO)
         1) T89, Determining the Liquid Limit of Soils
         2) T90, Determining the Plastic Limit and Plasticity Index of Soils
         3) T99, Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb.) Rammer and a 305-mm 12 inch (304.8 mm) Drop
         4) T238, Density of Soil and Soil Aggregate In Place By Nuclear Methods (Shallow Depth)
   2. Perform sieve analysis to develop grain size distribution curves for materials to be used for subgrade, fill under slap-on-grade, and backfills.
   3. Establish the moisture density relation of soils to be used as fill using the method best suited to the type of fill material.
   4. Determine moisture content of all fill materials before placement and advise Contractor when it is or is not suitable to achieve required compaction.
   5. Determine Liquid Limit in accordance with ASTM D4318, and AASHTO T89, Plastic Limit in accordance with ASTM D4318, and Plasticity Index in accordance with ASTM D4318 of all fill material.
   6. Perform one (1) in place density test for each 2,500 sq feet (2.69107 sq cm) of existing subgrade material.
   7. Perform Moisture-Density curve in accordance with ASTM D698 or AASHTO T99 for one (1) type of fill material. If the original choice of material does not meet the specifications, the Contractor shall pay for additional testing.
   8. Perform in place density tests of each lift compacted fill at locations adequate to evaluate the degree of compaction of all areas. Conducted one (1) test for each 2,500 sq feet (2.69107 sq cm) of each lift of compacted fill.

C. Reports: Submit reports to Architect with the following information:
   1. Type and condition of soil at footing bottoms.
   2. Level of water table in the excavated areas.
   3. Grain size distribution of fill materials (average of three (3) tests).
   4. Moisture density test results.
   5. In place density test results with moisture content and relative density of each layer of compacted fill. Include with in place density test results, a plan showing location of each test.
   6. Notify Architect by telephone within one (1) hour of the discovery of the following conditions and follow up telephone notification with written report.
      a. Materials used, or degree of soil compaction not meeting specified requirements.
      b. Frost and freeze protection requirements for excavation bottoms not being complied with.
      c. Water in excavations which is not being removed prior to work being performed in excavation.

3.07 DRILLED AND UNDERREAMED (BELLED) PEIRS

A. Inspection and Observation Services:
   1. Provide full time services for the review of all drilled pier foundation inspections. Including a daily report noting grid lines and locations of each pier drilled. After the foundation shaft has been drilled, the lab shall test an undisturbed sample and verify that it meets or exceeds the design specification.
   2. The drilling and verification of suitable soil for bearing capacity. Notify the Architect when soil with allowable bearing capacity noted is encountered at elevation above the bottom of the pier shown. Notify the Architect and Contractor if soil with required bearing capacity noted is not encountered at bottom of pier elevation shown. Bottom of pier shall be adjusted as recommended and approved by the Structural Engineer and Architect.
      a. Drilled shaft has been drilled plumb and within specified vertical and horizontal tolerances specified by the Structural Engineer.
      b. Drilled shaft and underreamed bells are excavated to specified depths and/or if conditions differ from those presented, to notify the Structural Engineer.
      c. Drilled shaft and underreamed bell bottoms are kept dry at all times, cleaned of excess cuttings, or all obstructions prior to placing reinforcing steel and concrete. If groundwater seepage occurs, it shall be removed prior to concrete placement or controlled with temporary steel casing to maintain the shaft integrity up to the concrete placement.
      d. Concrete reinforcing steel shall be checked for type, size, adequate placement and lap lengths, and doweled bars.

3.08 CONCRETE REINFORCING STEEL AND EMBEDDED METAL ASSEMNLIES

A. Inspection and Observation Services: Inspect all concrete reinforcing steel prior to placing of concrete for compliance with the Contract Documents and approved shop drawings. All instances of noncompliance with Contract Documents for correction and then if, uncorrected, report to the Architect.

B. Reports:
   1. Observe and Report of the Following:
      a. Number and size of bars.
      b. Bending and lengths of bars.
      c. Splicing.
      d. Clearance to forms including chair height.
      e. Clearance between bars or spacing.
      f. Rust, form oil, and other contamination.
      g. Grade of steels.
      h. Securing, typing, and chairing of bars.

2. Excessive congestion of reinforcing steel.
    a. Installation of anchor bolts and placement of concrete around such bolts.
    b. Fabrication of embedded metal assemblies, including visual inspection of all welds.
    c. Visually inspect studs and deformed bar anchors on embedded assemblies for compliance with Contract Documents. Check number, spacing and weld quality. If, after welding, visual inspection reveals that a sound weld or a full 360 degree fillet has not been obtained for a particular stud or bar, such stud or bar shall be struck with a hammer and bent 15 degrees off perpendicular and then bent back into position. Anchors failing this test shall be replaced.

C. Testing Services: Will be required of all suspect materials or workmanship at the direction of the Architect, Engineer, or Owner.

3.09 REINFORCING STEEL MECHANICAL SPLICES

A. Inspection and Observation Services:
1. Visually inspect and report on the completed condition of each mechanical splice of reinforcing steel.
2. Each mechanical splice shall be visually inspected to ensure compliance with the I.C.B.O. Reports and the manufacturer's published criteria for acceptable completed splices.
3. Special emphasis shall be placed on inspection of the end preparation of each bar to be spliced, as required by the I.C.B.O. Report.

B. Reports: Submit reports to Architect with the following information.
1. Submit copies of manufacturer's published criteria for acceptable completed splices prior to observing mechanical splices.
2. Reports on each mechanical splice shall indicate location of the splice, size of bars spliced, and acceptability or rejection of splice. Reasons for rejection shall be shown on each report.

3.10 CAST-IN-PLACE CONCRETE

A. Inspection and Observation Services:
1. Review concrete design mixes proposed for use on the Project.
2. Provide full time services for all structural building concrete in drilled piers, grade beams, slab on grade, columns, concrete paving, and other miscellaneous structural concrete. Refer to and include work for reinforcement steel specified in paragraphs 3.08 and 3.09 above.
3. On the first day's batching of each type and each strength of concrete, inspect and observe materials for concrete, batch weights, moisture content, and gradation of fine and coarse aggregate.
4. Provide additional inspection if the Contractor elects to use concrete from more than one (1) source of supply simultaneously. All costs for such additional inspection shall be borne by the Contractor.

B. Testing Services:
1. References (As applicable for field and laboratory tests):
    a. American Concrete Institute (ACI)
        1) 214, Recommendation practice for Evaluation of Strength Test Results of Concrete.
        2) 318, Building Code Requirements for reinforced Concrete.
    b. ASTM International (ASTM)
        1) ASTM C31/C31M, Practice for Making and Curing Concrete Test Specimens in the Field
        2) ASTM C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
        3) ASTM C138/C138M, Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
        4) ASTM C143/C143M, Slump of Hydraulic Cement Concrete

5) ASTM C173/C173M, Air Content of Freshly Mixed Concrete by the Volumetric Method.

2. Compression Test Cylinders:
3. Make, transport, cure and test six (6) inch diameter by 12 inch (304.8 mm) long test specimens taken from concrete being cast. Test cylinders will be made, handled, cured, and stored in accordance with ASTM C31/C31M, at the rate of four (4) cylinders minimum for each 50 cubic yards or fraction thereof of each class of concrete placed in any one (1) day.
   a. Handled newly made cylinders carefully to avoid cracking the green concrete. Store these cylinders in a box at temperatures between 60 degrees Fahrenheit (15.56 degrees Celsius) and 80 degrees Fahrenheit (26.67 degrees Celsius) during first 24 hours after casting to maintain these moist curing conditions until specimens are tested.
   b. Place cylinders in laboratory storage, with molds removed, under moist curing conditions and temperature of 73 degrees plus or minus three (3) degrees F 24 hours after casting maintain these moist curing conditions until specimens are tested.
   c. Of the test cylinders taken per 50 cubic yards or fraction thereof, test one (1) at seven (7) days and two (2) at 28 days after casting date. Store one (1) cylinder for testing at 56 days in the event the 28 days strength tests do not meet strength requirements. Test cylinders in accordance with ASTM C39/C39M. When type III cement is used, test at three (3) days instead of seven (7) days.
   d. Each 28 day compression test report shall clearly indicate average strength results, concrete slump and air content, concrete and ambient air temperatures, and how much water was added on site by contractors as of the report date and for the class of concrete being reported.
   e. Maintain a moving average for compressive strength based on the three (3) latest 28 day test results to check compliance with specification requirements. The figures for the standard deviation and moving average for strength will be kept continuously up to date and submitted on a weekly basis to the Architect and Engineer. Maintain a continuously up to date log in both graphical and tabulated form for each class of concrete.
      1) The average of the latest three (3) test results;
      2) The lowest average of three (3) consecutive test results recorded to date;
      3) The average of all sets of three (3) consecutive test results;
      4) The percentage of tests falling below specified strength;
      5) The lowest single test result.
4. Maintain a moving average for range of test results for quality control purposes as described in ACI 214, Chapter 4, Paragraphs 4.4 and 4.5. Graphical reports of moving average for range shall be submitted to the Architect and Engineer on a weekly basis.
   a. Slump Tests: Conduct in accordance with ASTM C143/C143M ASTM C143; one (1) test shall be performed for each sampling for strength tests. Slump shall be considered acceptable if the field test is within the range of design slump plus or minus one (1) inch. For concrete placed by pumping, one (1) test shall be performed at the pump and one (1) at the point of deposit Slump loss through pumping will be acceptable to the Architect and Engineer. Slump measured at the pump shall be evaluated for acceptance relative to the design slump in accordance with the criteria previously specified.
   b. Air Content Tests: Conduct in accordance with ASTM C173/C173M; test air entrained concrete only, one (1) test shall be performed for each sampling for strength tests. Air content shall be considered acceptable if the field test is in range of the design air content plus two (2) percent.
   c. Unit Weight Tests: Conduct in accordance with ASTM C138/C138M; test each sample of lightweight concrete taken for strength tests. Unit weight shall be

considered acceptable if the field test shows a fresh unit weight equal to the design unit weight plus or minus 2 pcf.

d. Chloride Tests: Perform one (1) total chloride ion test for each class of concrete placed each day. If the total chloride ion content is determined to be excessive by the Architect or Engineer, water soluble chloride ion tests shall be performed at the Contractor's expense.

5. Noncompliance: In the event of initial test above indicated that concrete may not meet the specified requirements, the Architect or Engineer may, at his discretion, order additional tests be performed at the Contractor's expense. Load tests shall comply with requirements of ACI 318.

3.11 MASONRY

A. Inspection and Observation Services:
1. Inspection of placement of reinforcement including condition, grade, size, location, spacing, and lap splices.
2. Review mortar design mixes.
3. Inspection of laying, mortaring, and grouting or concrete masonry units and elements.

B. Testing Services:
1. References (As applicable for tests required):
a. ASTM International (ASTM)
1) ASTM C140/C140M, Standard Test Methods of Sampling and Testing Concrete Masonry Units
2) ASTM C780, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
3) ASTM C1019, Standard Test for Sampling and Testing Grout
4) E447, Standard Test Method for Compressive Strength of Laboratory Constructed Masonry Prisms
2. Testing of Concrete Masonry Units (CMU)
a. Preconstruction: Perform the following tests in accordance with ASTM C140/C140M.
1) Compressive Strength
2) Absorption
3) Weight
4) Moisture Content
5) Dimensions
3. Mortar Tests:
a. Preconstruction: Perform the following tests in accordance with ASTM C780 on each type of mortar mix used in the Project.
1) 28 day Compressive Strength
2) Water Retention
b. Construction: Perform 28 day compressive strength test in accordance with ASTM C780 on each type of mortar mix used on the Project at the rate of one (1) test per 2,000 sq feet (2.15285 sq cm) of masonry.
4. Refer to and include work for reinforcing steel specified in Paragraphs 3.05 and 3.06 above.
5. Grout Tests:
a. Preconstruction: Perform the following tests in accordance with ASTM C1019 on each type of grout mix used on the Project.
1) Slump Test
2) 28 Day Compressive Strength
3) Construction: Perform 28 day compressive strength test in accordance with ASTM C1019 on each type of grout mix used on the Project at the rate of one (1) test per 2,000 sq feet (2.15285 sq cm) of masonry.

4) Prism Test: Perform preconstruction 28 day compressive strength test on concrete masonry walls in accordance with ASTM E447, Method B.

3.12 STRUCTURAL STEEL

A. Inspection Services:
1. General:
   a. Review submittals from fabricator.
   b. Review all shop and field welder's qualifications.
2. Structural Steel and Mechanical Piping:
   a. Shop inspect each member for defects such as cracks, excessive camber, deformation, and specified surface preparation prior to shop priming or galvanizing.
   b. Inspect shop priming for coverage and measure of mil thickness.
3. Perform visual inspection of all weld; measure 15 percent of welds.
   a. Inspect size and placement of anchors bolts in concrete and masonry.
   b. Verify erector surveys plumbness of each column.
   c. Verify erector inspects alignment of beams, shelf angles, lintels, joists, joist girders, and other similar supporting members.
   d. Perform visual inspection of bolts to determine that the method(s) used are in conformance with the Contract Documents.
4. Steel Stud Shear Connectors:
   a. Field inspect installation methods and welds.
   b. Verify number of studs, stud placement and length for conformation with the Contract Documents.

B. Testing Services:
1. References (As applicable for tests required):
   a. American Institute of Steel Construction (AISC)
      1) Specifications for Structural Joints Using ASTM A325 or A490 Bolts
   b. ASTM International ASTM
2. ASTM A6/A6M, General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
3. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
      1) A490, Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
   b. American Welding Society (AWS)
      1) AWS D1.1/D1.1M D1.1, Structural Welding Code, Steel
4. Structural Steel:
   a. Perform all tests required by Structural Welding Code and authorities having jurisdiction.
   b. Ultrasonically test all edges of material greater than 1-1/2 inch (38 mm) thick that is to be welded for evidence of laminations, inclusions, or other discontinuities. The extent of such defects will be permitted and the extent of repair permitted shall be in accordance with ASTM A6/A6M.
   c. The root layer of all multiple pass welds and the backside of groove welds made from both sides, after back gouging or chipping, shall be tested by magnetic particle or dye penetration if magnetic particle is not feasible.
5. Fillet welds for beam and girder shear connections (15 percent at random) shall be tested by magnetic particle for final pass only.
   a. Fillet welds for plate girder flange/web connections shall be tested by magnetic particle for final pass only.
   b. Ultrasonically test 100 percent of full penetration welds.
   c. Ultrasonically test 100 percent of partial penetration column splice welds.
   d. Test 100 percent of continuity plate fillet welds by magnetic particle for final pass.

e. Perform all equipment calibrations and production tests of high strength bolt connections as required by AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
f. Randomly sample bolts, nuts, and washers from the Project Site at a rate sufficiently to test and verify compliance with ASTM Standards.
g. When bolts are tightened by “turn-of-the-nut” method, check by calibrated torque wrench 25 percent of bolts in each shear connection, but not less than two (2) bolts per connection.
h. In addition provide at least one (1) test per 50 linear inches of weld by each welder, except that 100 percent of full penetration welds shall be tested using approved radiographic, magnetic particle, or ultrasonic method. Tolerance for welds shall be in accordance with the requirements of AWS D1.1/D1.1Mand the Contract Drawings.
i. Perform tension tests on steel in accordance with ASTM A6/A6M, if required.
j. Perform load tests on structural members in place, if required.

6. Steel Stud Testing:
   a. Test not less than ten (10) percent of studs on any beam, plus all studs indicating imperfections. Studs will be considered imperfect if, after welding, visual inspection reveals:
      1) Studs lacking full 360 degree weld.
      2) Studs which have been repaired by welding.
   b. Studs shall be tested by striking with a hammer and bending to approximately 15 degrees weld off vertical. Bend studs lacking full 360 degrees weld in a direction opposite to the side lacking the weld. Replace studs that crack after this test either in the weld or the shank. Studs meeting this test will be considered acceptable and left in place.

3.13 SPRAYED-ON FIREPROOFING

A. Inspection Services: Inspection of sprayed-on fireproofing to ascertain compliance with Contract Documents.

B. Testing Services:
   1. References (As applicable for tests required):
      a. ASTM International (ASTM):
         1) ASTM E605/E605M, Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members
         2) ASTM E736/E736M, Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members
   2. Perform tests on sprayed-on fireproofing for thickness and density in accordance with ASTM E605/E605M.
   3. Perform tests on sprayed-on fireproofing for cohesion and adhesion in accordance with ASTM E736/E736M.

END OF SECTION 01 43 00

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.02 GENERAL:

A. Furnish all temporary facilities, utilities and services necessary to complete the Work, including water, sanitary facilities, electrical lighting, power, telephone, heating, ventilating, air conditioning, security and regularly-scheduled trash removal.

B. Provide use of temporary facilities, utilities and services to Owner's separate contractors, if any, as necessary for the accomplishment of the work of their respective contracts for the completion of the Project, except as otherwise specifically indicated.

C. Separate contractors shall provide their own tools, construction equipment, ladders, scaffolding, and temporary storage facilities (except where feasible to store materials within the building).

D. Contractor shall provide adequate provisions for onsite operations of temporary facilities, equipment and operations of the Fire Department Onsite activities, personnel equipment, supplies and materials shall not interfere nor hinder access for the Fire Department.

1.03 QUALITY ASSURACNE: COMPLY WITH APPLICABLE CODES AND STANDARDS.

1.04 PROJECT CONDITIONS: KEEP SERVICES AND FACILITIES CLEAN AND NEAT IN APPEARANCE. ALLOW NO PUBLIC NUISANCES OR DANGEROUS, HAZARDOUS OR UNSANITARY CONDITIONS AT THE SITE. DO NOT OVERLOAD FACILITIES.

1.05 PROGRESS CLEANING

A. General: Clean Project site work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees Fahrenheit (26.67 degrees Celsius).
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site; Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

1.06 EROSION AND SEDIMENTATION CONTROL

A. To the maximum extent practicable, prevent erosion or displacement of soils and discharge of soil-bearing water runoff to adjacent properties and waterways.

B. Provide erosion and sedimentation control during the entire project in accordance with applicable laws, regulations, requirements and guidelines of all authorities having jurisdiction.

C. See Section 01 57 00 - Source Control for additional information.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Provide equipment suitable for use intended.

B. First Aid Supplies: Comply with governing regulations.

C. Fire Extinguishers: Provide hand-carried, portable UL-rated class “A” fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class “ABC” dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposure.

PART 3 EXECUTION

3.01 TEMPORARY FACILITIES, UTILITIES, PROTETION AND CONTROLS

A. Provide and maintain construction equipment and storage facilities for the Work of this Contract:
   1. Construction equipment.
   2. Dewatering and pumping equipment
   3. Storage facilities, including watertight storage for all materials and equipment which could be damaged by storage in the open.

B. Provide security and protection requirements:
   1. Fire extinguishers.
   2. Building enclosure and lock-up.
   3. Temporary fencing or enclosures with locking gates or doors for portions of the building that are not enclosed or lockable, areas where building materials and equipment are stored and elsewhere, to the extent deemed by the Contractor to be necessary for safety and security. Owner temporary facilities and operations shall not be enclosed within site temporary fencing.
   4. Pest control.

C. Provide construction and personnel supporting facilities:
   1. Contractor’s field office for use of all involved in the Project; pay for all local calls. Long distance calls shall be paid by the party making the call.
   2. Water and sanitary facilities.
   3. Lighting and power.
   4. Heating, ventilating and air conditioning.
   5. Regularly-scheduled trash removal.

D. Provide protection, operate facilities and conduct operations to comply with environmental regulations and minimize the possibility that air and waterways might be contaminated or polluted, or that other undesirable effects might result.
   1. Comply with regulations of governing authorities.
      a. Prevent soil erosion and sedimentation on site and onto or into adjoining property, utilities, storm sewers, easements and rights-of-way.
   2. Remove promptly and properly dispose of standing water.
   3. Take necessary fire prevention measures. Do not burn waste materials.
   4. Do not bury debris or excess materials on the Owner's property.
   5. Do not discharge harmful or dangerous materials into drains.
   6. Remove waste materials from the site and dispose of legally.
   7. Operate safely and efficiently.

E. Site Enclosure Fence: Before enclosure operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates. Enclosures shall allow for the access and operations temporarily onsite housing of Fire Department Personnel.

END OF SECTION 01 50 00

SECTION 01 55 13
STABILIZED CONSTRUCTION EXIT

PART 1 GENERAL

1.01 SCOPE

A. This Section describes the installation of erosion and sedimentation control for stabilized construction exits utilized during construction and prior to the final development of the site.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Special Conditions, and Division 1 Specification Sections, apply to this Section.

1.03 REFERENCE STANDARDS

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM).

C. ASTM D4632/D4632M – Standard Test Method for Breaking Load and Elongation of Geotextile (Grab Method)

1.04 SUBMITTALS

A. Manufacturer's catalog sheets and other pertinent information on geotextile fabric.

B. Sieve analysis of aggregates conforming to requirements of this Section.

PART 2 PRODUCTS

2.01 SEPARATION GEOTEXTILE

A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material. Geotextile fabric shall have a minimum grab strength of 270 psi (1861.59 kPa) in any principal direction (ASTM D4632/D4632M) and the equivalent opening size between 50 and 140, with the appropriate opening size to be approved in the review process based on the characteristics of the disturbed material. Both the geotextile and the threads shall be resistant to chemical attack, mildew and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide minimum of six months of expected usable construction life at a temperature range of 0 degrees Fahrenheit (-17.78 degrees Celsius) to 120 degrees F. Representative Manufacturer: Mirafi Inc., Curlex, or preapproved equivalent.

2.02 COARSE AGGREGATES

A. Coarse aggregates shall consist of crushed stone, gravel, crushed blast furnace slag, or combinations thereof. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall conform to the following gradation requirements.

1. Sieve Size (Square Mesh) Percent Retained (By Weight)
2. 2-1/2 0
3. 2" 0 – 20
4. 1-1/2" 15 – 50
5. 3/4" 60 – 80
6. No. 4 95 – 100

PART 3 EXECUTION

3.01 GENERAL

A. To keep the street clean of mud generated by construction vehicles and equipment, Contractor shall provide stabilized construction exits at the construction site, staging, parking, storage, and/or disposal areas. Such erosion and sediment control system shall be constructed in

accordance with the Detail – Stabilized Construction Exit attached hereto or shown on the Drawings, and any additional requirements shown on the Drawings and set out in this Section.

B. No clearing and grubbing or rough cutting, other than as specifically directed by the Owner to allow soil testing and surveying, shall be permitted until erosion and sedimentation control systems.

C. Maintain existing erosion and sedimentation control systems located within the project site until acceptance of the project pr until directed by the Owner to remove and discard the existing system.

D. Regularly inspect and repair or replace components of stabilized construction exits. Unless otherwise directed, maintain the erosion and sedimentation until the project is accepted by the Owner. Remove erosion and sedimentation control systems promptly when directed by the Owner. Discard removed materials offsite.

E. Remove and dispose sediment deposits at the project designate spoil site. If a project spoil site is not designated on the Drawings, dispose of sediment offsite at location not in or adjacent to stream or floodplain. Off-site disposal will be the responsibility of the Contractor. Sediment to be placed at the project site should be spread evenly throughout the site, compacted and stabilized. Sediment shall not be allowed to flush into stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state and local rules and regulations.

F. Equipment and vehicles of the Contractor, or on-site for his use, shall be prohibited from maneuvering on areas outside of the construction limits. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.

G. Conduct all construction operations under this Contract in conformance with the erosion control practices described in the Section 01 57 00 - Source Control.

3.02 CONSTRUCTION METHODS

A. Provide stabilized exits, entrances, access roads, parking areas, and other on-site vehicle transportation routes where shown on the Drawings.

B. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto area roadways. When washing is needed to remove sediment, Contractor shall construct a truck washing area. Truck washing shall be done on stabilized areas, which drain into a drainage system protected by erosion and sediment control measures.

C. Details for stabilized construction exits are shown on the civil drawings. Construction of other stabilized areas shall be to the requirements. Roadway width shall be at least 30 feet (914.4 cm) and shall be sufficient for all ingress and egress to the site. Furnish and place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlaying soil. Exposure of geotextile fabric to the elements between laydown and cover shall be a maximum of fourteen days to minimize damage potential.

D. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sand bags, gravel, boards, or similar methods to prevent sediment from entering area roadways, receiving stream or storm water conveyance system.

E. The stabilize areas shall be inspected and maintained daily. Provide periodic top dressing with additional coarse aggregates to maintain the required depth. Repair and clean out damaged measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto area roadways shall be removed immediately.

F. The length of the stabilized area shall be as shown on the Detail or as shown on the Drawings, but not less than 50 feet (1524 cm) in length. The thickness shall not be less than 8 inches (203.2 mm). The width shall not be less than full width of all points of ingress or egress.

G. Stabilization for other areas shall have the same thickness, and width requirements as the stabilized construction exit, except where specified otherwise on the Drawings. The aggregate shall be a compacted limestone base material, 8 inches (203.2 mm) in thickness, with an

application of emulsified asphalt. The emulsified asphalt material shall be reapplied periodically following any regrading of the limestone surface.

H. Stabilized area may be widened or lengthened to accommodate truck-washing area as required by the Contractor and approved by the Owner.

I. Alternative methods of construction, when preapproved by the Owner, may include the following.
   1. Cement Stabilized Soil – Compacted cement stabilized soil or other fill material in an application thickness of at least 8 inches (203.2 mm).
   2. Wood Mats/ Mud Mats – Oak or other hardwood timbers placed edge to edge and across support wooden beams which are placed on top of existing soil in an application thickness of at least 6 inches (152.4 mm).
   3. Steel Mats – Perforated mats placed across perpendicular support members.

3.03 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this Section. Include all costs in the lump sum price, or in the unit price for Storm Water Pollution Prevention Plan.

END OF SECTION 01 55 13

SECTION 01 55 13.10
STABILIZED CONSTRUCTION ACCESS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of erosion and sediment control for stabilized construction access points used during construction and until final development of the site.

1.02 SUBMITTALS

A. Manufacturer's catalog sheets and other product data on geotextile fabric.

B. Sieve analysis of aggregates conforming to requirements of this Specification.

1.03 UNIT PRICES

A. Unless indicated in the Unit Price Schedule as a pay item, no separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items for which this work is a component.

B. When indicated in the Unit Prices Schedule, include stabilized exits under payment for Street Cleaning as Required by NPDES, including stabilized construction roads, parking areas, exists, and truck washing areas will included and be full compensation for all labor, equipment, materials, supervisions, and all incidental expenses for construction of these items, complete in place, including, but not limited to, embankment and excavation, maintenance requirements, repair and replacement of damaged sections, removal of sediment deposits, redressing of aggregates and stones, cleaning of streets, and removal of erosion and sediment control systems at the end of construction.

1.04 REFERENCES

A. ASTM D4632/D4632M – Standard Test Method for Grab Breaking Load and Elongation of Geotextile.

PART 2 PRODUCT

2.01 GEOTEXTILE FABRIC

A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material.

B. Geotextile fabric shall have a minimum grab strength of 270 psi (1861.59 kPa) in any principal direction (ASTM D4632/D4632M), and the equivalent opening size between 50 and 140.

C. Both the geotextile and threads shall be resistant to chemical attack, mildew, and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable life at a temperature range of 0°F to 120°F.

D. Representatives Manufacturers: Mirafi Inc., or equal.

2.02 COARSE AGGEGATES

A. Coarse Aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or a combination of these materials. Aggregate shall be composed of clean, hard, durable materials, or organic and injurious matter.

B. Coarse aggregate shall be 2" to 5" in size. No crushed concrete will be allowed.

PART 3 EXECUTION

3.01 PREPARATION AND INSTALLATION

A. If necessary to keep the street clean of mud carried by construction vehicles and equipment, Contractor shall provide stabilized construction and exits at the construction, staging, parking, storage, and disposal areas. Such erosion and sediment controls shall be constructed in accordance with the requirements shown on the Drawings and specified in this Section.

B. No cleaning and grubbing or rough cutting shall be permitted until erosion and sediment control systems are in place, other than as specifically directed by the Owner's Representative to allow soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within the project site until acceptance of the project or until directed by the Owner's Representative to remove and discard the existing system.

D. Regularly inspect and repair or replace components of stabilized construction access points. Unless otherwise directed, maintain the stabilized construction roads and access points until the project is accepted by the Owner. Remove stabilized construction roads and access points promptly when directed by the Owner's Representative. Discard removed materials off site in accordance with the requirements of Division 1.

E. Remove sediment deposits and dispose of them at the designated spoil site for the project. If a project spoil site is not designated on the Drawings, dispose of sediment off site at location not in or adjacent to a stream or floodplain. Off-site disposal is the responsibility of the Contractor. Sediment to be placed at the project site should be spread evenly throughout the site, compacted and stabilized. Sediment shall not be allowed to flush into a stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state, and local rules and regulations.

F. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately.

G. Conduct all construction operation under this Contract in conformance with erosion control practices described in Division 1.

3.02 CONSTRUCTION METHODS

A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.

B. Provide stabilized construction exits, and truck washing areas when approved by Owner's Representative, of the sizes and locations where shown on Drawings or as specified in this Section.

C. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto public right-of-way. When washing is needed to remove sediment, Contractor shall construct a truck washing area. Truck washing shall be done on stabilized areas which drain into a drainage system protected by erosion and sediment control measures.

D. Details for stabilized construction access points are shown on the Drawings. Construction of all other stabilized areas shall be to the same requirements. Roadway width shall be at least 14 feet (426.72 cm) for one-way traffic and 20 feet (609.6 cm) for two-way traffic and shall be sufficient for all ingress and egress. Furnish and place geotextile fabric as permeable separator to prevent mixing of coarse aggregate with underlying soil. Exposure of geotextile fabric to the elements between laydown and cover shall be a maximum of 14 days to minimize damage potential.

E. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar methods to prevent sediment from entering public right-of-way, receiving stream or storm water conveyance system.

F. The stabilized areas shall be inspected and maintained daily. Provide periodic top dressing with additional coarse aggregates to maintain the required depth. Repair and clean out damaged control measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.

G. The length of the stabilized area shall be as shown on the Drawings, but not less than 50 feet (1524 cm). The thickness shall not be less than 8 inches (203.2 mm). The width shall not be less than the full width of all points of ingress or regress.

H. Stabilization for other areas shall have the same coarse aggregate, thickness, and width requirements as the stabilized construction access points, except where shown otherwise on the Drawings.

I. Stabilized area may be widened or lengthened to accommodate truck washing area when authorized by Owner's Representative.

J. Alternative methods of construction may be utilized when shown on Drawings, or when approved by the Owner's Representative. These methods include the following:
   1. Cement-Stabilized Soil – Compacted cement-stabilized soil or other fill material in an application thickness of at least 8 inches (203.2 mm).
   2. Wood Mats/Mud Mats – Oak or other hardwood timbers placed edge-to-edge and across support wooden beams which are placed on top of existing soil in an application thickness of at least 6 inches (152.4 mm).
   3. Steel Mats – Perforated mats placed across perpendicular support members.

END OF SECTION 01 55 13.10

SECTION 01 55 26
TRAFFIC CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for signs, controls devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.

B. Qualifications and requirements for use of flagmen.

1.02 MEASUREMENT AND PAYMENT

A. Unit Price Contracts.
   1. Traffic control and regulation. Payment for traffic control and regulation is on a lump sum basis. Include preparation and submittal of traffic control plan if different than shown on Drawings, and provision of traffic control devices, equipment, and personnel necessary to protect the Work and public. Payment will be based on Contractor's Schedule of Values for traffic control and regulation.
   2. Flagmen: Payment for flagmen is on a lump sum basis. Partial payments will be based on Contractor's Schedule of Values for flagmen.
   3. Refer to Division 1 for unit price procedures.

B. Stipulated Price Contracts: Include payment for work under this section in the total Stipulated Price.

1.03 REFERENCES

A. Texas Manual on Uniform Traffic Control Devices (TMUTCD).

B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code or Criminal Procedure.

1.04 SUBMITTALS

A. Conform to requirements of Division 1.

B. Traffic control plan:
   1. If using traffic control plan contained in the Contract without modification, submit a letter confirming use of the plan.
   2. If using a different traffic control plan, submit the plan for approval to the local Governing Jurisdiction, Owner and Engineer. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer. The contractor is responsible for obtaining approval from the Governing entity if using an alternate plan.

C. Submit copies of approved lane closure permits issued by all governmental authorities.

D. Submit Schedules of Values for traffic control plan and flagmen within 30 days following Notice to Proceed.

E. Submit records verifying qualifications of Uniformed Peace Officers and Certified Flagmen proposed for use on the Work.

1.05 FLAGMEN

A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffics lanes.

B. Uniformed Peace Officer: Individual employed full-time as a peace officer who receives separate compensation as a privately employed flagman. Private employment may be an employee-employer relationship or on an individual basis. Flagman may not be in the employ of another peace officer nor be a reserve peace officer.
   1. Uniformed Peace Officer may be:
      a. Sheriffs and their deputies;
      b. Constables and deputy constables;

c. Marshals or police officers of an incorporated city, town or village; or
d. As otherwise provided by Article 2.12, Code of Criminal Procedure.

2. The Uniformed Peace Officer must be a full-time peace officer, must work a minimum average of 32 paid hours per week, and must be paid a rate not less than the prevailing minimum hourly wage rate set by the federal Wage and Hour Act. The individual must be entitled to vacation, holidays, and insurance and retirement benefits.

C. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:
1. Formally trained and certified in traffic control procedures by the City's E.B. Cape Center.
2. Speaks English. Ability to speak Spanish is desirable but not required.
3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City of Houston's Wage Scale for Engineering Construction.

D. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

PART 2 PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

A. Comply with TMUTCD requirements.

B. Traffic canes and drums, flares and lights: Conform to local jurisdictions' requirements.

2.02 PORTABLE LOW PROFILE CONCRETE BARRIERS

A. The low profile concrete barrier is a patented design. Information concerning this barrier may be obtained from Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843-3135, (409) 845-1712.

PART 3 EXECUTION

3.01 PUBLIC ROADS

A. Submit requests forms for lane closure and sidewalk closure to the appropriate governmental authority at least three working days prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approved permits.

B. Follow laws and regulations of governing jurisdiction when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinating activities with the Owner's Representative.

C. Give Owner's Representative one-week notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.

D. Notify police department, fire department, METRO, and local schools, churches, and businesses in writing a minimum of five business days prior to beginning work.

E. Maintain 10-foot-wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.

F. Do not obstruct normal flow of traffic from 7:00 a.m. to 9:00 a.m. and from 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by Owner's Representative.

G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by Owner's Representative to maintain temporary driveway access to commercial and residential driveways.

H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with applicable ordinances.

I. Remove existing signage and stripping that conflict with construction activities or that may cause driver confusion.

J. Provide safe access for pedestrians along major cross streets.

K. Alternate closure of cross streets so that two adjacent cross streets are not closed simultaneously.

L. Do not close more than two consecutives esplanade openings at a time without prior approval from Owner's Representative.

3.02 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.03 FLARES AND LIGHTS

A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.04 HAUL ROUTES

A. Utilize haul routes designated by authorities or shown on Drawings for construction traffic.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.05 TRAFFIC SIGNS AND SIGNALS

A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits, traffic signal writing and crosswalk signals. Notify the governmental agency having jurisdiction a minimum of 60 days in advance of need for control boxes and switchgear. The Contractor will pay for all necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.

B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.

C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.

D. Unless otherwise approved by Owner's Representative, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.

E. Replace existing traffic control devices in Project area.

F. Owner's Representative may direct Contractor to make minor adjustments to traffic control signage to eliminate driver confusion and maintain orderly traffic flow construction at no additional cost to the Owner.

3.06 BRIDGING TRENCHES AND EXCAVATIONS

A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drivers. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise.

B. Shore trench or excavation to support bridge and traffic.

C. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:
   1. Bridging is placed over existing bus routes,
   2. More than five percent of daily traffic is comprised of commercial or truck traffic,
   3. More than two separate plates are used for bridging, and
   4. When bridge is to be used for more than five consecutive days.

D. Extend steel plates used for bridging a minimum of 1 foot (30.48 cm) beyond the edge of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

3.07 REMOVAL

A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

C. Remove post settings to a depth of 2 feet (60.96 cm).

3.08 TRAFFIC CONTROL, REGULATION AND DIRECTION

A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:
   1. Multi-lane vehicular traffic must be diverted into single lane vehicular traffic,
   2. Vehicular traffic must change lanes abruptly,
   3. Construction equipment must enter or cross vehicular traffic lanes and walks,
   4. Construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalks,
   5. Traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and
   6. Where construction activities might affect public safety and convenience.

B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relive Contractor of responsibility to take other means necessary to protect the Work and public.

3.09 INSTALLATION STANDARDS

A. Place temporary pavement for single lane closures, in accordance with TMUTCD.

B. Reinstall temporary and permanent pavement markings as approved by Owner's Representative. When weather conditions do not allow application according to manufacturer's requirements, alternate markings may be considered. Submit proposed alternate to Owner's Representative for approval prior to installation. No additional payment will be made for use of alternate markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

A. Submit name, address and telephone number of individual designated to be responsible for maintenance of traffic handling at construction site to Owner's Representative. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.

B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Owner's Representative. Immediately repair, clean, relocate, or replace equipment or materials that are not in compliance.

C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.

D. Obtain approval of Owner's Representative to reuse damaged or vandalized signs, drums, and barricades.

END OF SECTION 01 55 26

SECTION 01 57 00
SOURCE CONTROL

PART 1 GENERAL

1.01 SCOPE

A. This Section describes erosion and sedimentation control and other related practices, which shall be utilized during construction activities.

1.02 RELATED DOCUMENTS

A. Drawings and general provision of Contract, including General Conditions, Special Conditions, and Division 1 Specification Sections, apply to this Section.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 GENERAL

A. No clearing and grubbing and rough cutting shall be permitted until erosion and sedimentation control systems are in place.

B. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated construction area. Damages caused by construction traffic or others to erosion and sedimentation control system shall be repaired immediately by the Contractor.

C. The Contractor shall be responsible for collecting, storing, hauling, and disposing of spoils, silt, and waste materials as specified on the Drawings and in this or other Technical Specifications and in compliance with applicable federal, state, and local rules and regulations.

D. Contractor shall conduct all construction operation under this Contract in conformance with the erosion control practices described on the Drawings, the Storm Water Pollution Prevention Plan and this Section.

E. The Contractor shall install, maintain, and inspect erosion and sediment control measures and practices as specified on the Drawings and in this and other Technical Specifications.

F. Contractor shall employ protective measures to avoid damage to existing trees to be retained on the Project site.

3.02 TOPSOIL PLACEMENT FOR EROSION AND SEDIMENTATION CONTROL SYSTEMS

A. When topsoil is called for as a component of another Section, the Contractor shall conduct erosion control practices described in this Section during topsoil placement operation.

B. When placing topsoil, maintain erosion and sedimentation control systems.

C. Maintain grades, which have been previously established on areas to receive topsoil.

D. After the areas to receive topsoil have been brought to grade, and immediately prior to dumping and spreading the topsoil, the subgrade shall be loosened by dicing or by scarifying to a depth of at least two (2) inches to permit bonding of the topsoil to the subsoil.

E. No sod or seed shall be placed on soil, which has been treated with soil sterilants until sufficient time has elapsed to permit dissipation of toxic materials.

3.03 DUST CONTROL

A. Dust control methods shall be implemented to control dust creation and movement on construction sites and roads and to prevent airborne sediment from reaching receiving stream or storm water conveyance system, to reduce on and offsite damage, to prevent health hazards, and to improve traffic safety.

B. Contractor shall control dust blowing by utilizing one or more of the following methods:
   1. Mulches bound with chemical binders.
   2. Temporary vegetative cover.
   3. Spray-on adhesives on mineral soils when not used by traffic.

4. Tillage to roughen surface and bring clods to the surface.
5. Irrigation by water sprinkling.
6. Barriers using solid board fences, snow fences, burlap fences, crate walls, bales or hay, or similar materials.

C. Dust control methods shall be implemented immediately wherever dust can be observed blowing on the project site.

D. Owner's temporary facilities shall be protected from debris and dust during entirety of construction activities. Installation of 6' high woven UV stabilized Polyethylene fabric fence with brass grommets shall be installed along fence.

3.04 KEEPING STREETS CLEAN

A. Contractor shall keep the streets clean of construction debris, dirt, and mud generated by construction vehicles and equipment. If necessary to keep the streets clean, Contractor shall provide stabilized construction exists at construction, staging, storage, and disposal areas. A vehicle/equipment wash area (stabilized with coarse aggregate) may be installed adjacent to the location of stabilized construction exit, as needed. Wash water shall be released into a drainage swale or inlet protected by erosion and sediment control measures.

B. In lieu of or in addition to stabilized construction exits, Construction shall shovel and/or sweep the pavement to the extent necessary to keep the street clean. Water hosing or sweeping of debris and mud off of the street into adjacent areas is not allowed.

3.05 EQUIPMENT MAITAINENCE AND REPAIR

A. Maintenance and repair of construction machinery and equipment shall be confined to areas specifically designated for that purpose. Such designated areas shall be located and designed so that oils, gasoline, grease, solvents, and other potential pollutants cannot be washed into receiving streams or storm water conveyance systems. These areas shall be provided with adequate waste disposal receptacles for liquid as well as solid waste. Maintenance areas shall be inspected and cleaned daily.

B. On the construction site where designated equipment maintenance areas are not feasible, care shall be taken during each individual repair or maintenance operation to prevent potential pollutants from becoming available to be washed into streams or conveyance systems. Temporary waste disposal receptacles shall be provided.

3.06 WASTE COLLECTION AND DISPOSAL

A. Contractor shall formulate and implement a plan for the collection and disposal of waste material on the construction site. The plan must designate locations for trash and waste receptacles and establish a collection schedule. Methods for ultimate disposal of waste shall be specified and carried out in accordance with applicable local, state and federal health and safety regulations. Special provisions shall be made for the collection and disposal of liquid wastes and toxic or hazardous materials.

B. Receptacles and other waste collection areas shall be kept neat and orderly to the extent possible. Waste shall not be allowed to overflow its container or accumulate for excessively long periods of time. Trash collection points shall be located where they will at least likely be affected by concentrated storm water runoff.

3.07 WASHING AREAS

A. Vehicles such as concrete or dump trucks and other construction equipment shall not be washed at locations where the runoff will flow into a watercourse or storm water conveyance system. Special areas shall be designated for washing vehicles. These areas should be located where the wash water will spread out and evaporate or infiltrate directly into the ground, or where the runoff can be collected in a temporary holding or seepage basin. Wash areas shall have gravel or rock bases to minimize mud generation. These areas shall be completely cleaned up, have waste remains hauled off, and be stabilized and seeded after the area is no longer required.

3.08 STORAGE OF CONSTRUCTION MATERIALS, CHEMICALS, ETC.

A. Sites where chemicals, cements, solvents, paints, or other potential water pollutants are to be stored, shall be isolated in areas where they will not cause runoff pollution.

B. Toxic chemicals and materials, such as pesticides, paints, and acids shall be stored in accordance with manufacturer's guidelines. Groundwater resources shall be protected from leaching by placing a plastic mat, packed clay or other impervious materials on any areas where toxic liquids are to be opened and stored.

3.09 DEMOLITION AREAS

A. Demolition work, which generates large amounts of dust, shall be provided with dust control techniques to limit the transport of the airborne pollutants. However, water or slurry used to control dust shall not ne allowed to run directly into watercourses or storm water conveyance systems. Methods of ultimate disposal of these materials shall be carried out in accordance with applicable local, state or federal health and safety regulations.

3.10 SANITARY FACILITIES

A. The construction site must be provided with adequate sanitary facilities for workers in accordance with Division 1 and applicable health regulations.

3.11 PESTICIDES

A. The use of pesticides shall be approved by the Owner prior to application. A one-week notice will be required of the Contractor.

B. Pesticides sed during construction shall be stored and used in accordance with manufacturer's guidelines and with local, state and federal regulations. Overuse of pesticides, which could generate contaminated runoff, shall be avoided and great care shall be taken to prevent accidental spillage. Pesticide containers shall never be washed in or near flowing streams or storm water conveyance systems.

3.12 PROTECTION OF TREES IN CONSTUCTION AREAS

A. Heavy equipment, vehicular traffic, and stockpiles of construction materials, including topsoil, are not permitted within the dripline or any tree to be retained. Contractor shall avoid all contact with trees to be retained unless otherwise directed by the Owner or required by the work under this Contract.

B. Specimen trees shown on the Drawings shall be boxed or fenced. When called for in the Drawings, tunnel under the root system for the installation of utility lines.

C. Tree trunks, exposed roots, and limbs of the trees designated to be retained, which are damaged during construction operations, will be cared for and prescribed by a forester or licensed tree expert at the expense of the Contractor.

3.13 MEASURMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum priced, or in the unit price for Storm Water Pollution Prevention Plan.

END OF SECTION 01 57 00

SECTION 01 57 10
TPDES REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR 150000 (the Construction General Permit).

B. Implementation, maintenance, inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices shown on the Drawings or specified elsewhere in the Contract.

C. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with the Owner's Representatives prior to start of construction.

1.02 DEFINITIONS

A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavating.

B. Large Construction Activity: Project that:
   1. Disturbs five acres or more, or
   2. Disturbs less than five acres but is part of a larger common plan of development that will disturb five acres or more of land.

C. Small Construction Activity: Project that:
   1. Disturbs one or more acres but less than five acres, or
   2. Disturbs less than one acre but is part of a larger common plan of development that will ultimately disturb one or more acres but less than five acres.

D. TPDES Operator:
   1. The person or persons who have day-to-day operational control of the constitution activities which are necessary to ensure compliance with the SWP3 for the site or other Construction General Permit conditions.

1.03 REFERENCE STANDARDS

A. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Prepare a SWP3 following Part III of the Construction General Permit and the applicable local code. If conflicts exist between the Construction General Permit and the local regulations, the more stringent requirements will apply.

B. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.

C. Submit the SWP3 and any updates or revisions to the Owner's Representative for review and address comments prior to commencing, or continuing, construction activities.

3.02 NOTICE OF INTENT FOR LARGE CONSTRUCTION ACTIVITY

A. Fill out, sign, and date TCEQ Form 20022 Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR 150000). Contractor shall provide NOI forms for both himself and Owner.

B. Transmit the signed Contractor's copy of TCEQ Form 20022, along with a check for the required fee, made out to Texas Commission on Environmental Quality.

C. Submission of the notice of the Intent form by the Contractor to TCEQ is required a minimum of fourteen days before Commencement of Construction Activities.

3.03 CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION ACTIVITY

A. Fill out, sign, and date the Construction Site Notice, Attachment 2 to TPDES General Permit TXR 150000, “Construction Site Notice”.

B. Transmit the signed Construction Site Notice to the Engineer and Owner at least seven days prior to Commencement of Construction Activity.

3.04 CERTIFICATION REQUIREMENTS

A. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor’s Certification for Inspection and Maintenance. Use the EPA (NPDES) Construction Inspection Form.

3.05 RETENTION OF RECORDS

A. Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR 150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to the Owner’s Representative.

3.06 REQUIRED NOTICES

A. Post the following notices from effective from date of the SWP3 until date of final site stabilization as defined in the Construction General Permit:
   1. Post the TPDES permit number for Large Construction Activity or a signed TCEQ Construction Site Notice for Small Construction Activity. A signed copy of the Contractor’s NOI must also be posted.
   2. Post notices near the main entrance of the construction site in a prominent place for public viewing. Post name and telephone number of Contractor’s local contact person, brief project description and location of SWP3.
      a. If posting near a main entrance is not feasible due to safety concerns, coordinating posting of notice with Owner’s Representative to conform to requirements of the Construction General Permit.
      b. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.
   3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post each stabilized construction exit area.
   4. Post a notice of waste disposal procedures in a readily visible location on site.

3.07 ON-SITE WASTE MATERIAL STORAGE

A. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.

B. Prepare list of waste material to be stored on-site. Update list necessary to include up to-date information. Keep a copy of updated list with the SWP3.

C. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

3.08 NOTICE OF TERMINATION

A. Submit a NOT to TCEQ and the Engineer within 30 days after:
   1. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor; or
   2. Another operator has assumed control over all areas of the site that have not been stabilized; and
   3. All silt fences and other temporary erosion controls have either been removed, scheduled to be removed as defined in the SWP3, or transferred to a new operator if the operator has sought permit coverage.

END OF SECTION 01 57 10

SECTION 01 57 13
FILTER FABRIC FENCE

PART 1 GENERAL

1.01 SCOPE

A. This Section describes the installation of erosion and sedimentation control filter fabric fences (FFF) utilized during construction. The filter fabric fences are to be used to contain pollutants from overland flow. This practice shall not be used in channelized flow areas.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Special Conditions, and Division 1 Specification Sections, apply to this Section.

1.03 REFERENCE STANDARDS

A. The publications listed below forms a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. American Society for Testing and Materials (ASTM).

C. ASTM D3786/D3786M – Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics – Diaphragm Bursting Strength Tester Method.

D. ASTM D4632/D4632M – Standard Test Method for Breaking Load and Elongation of Geotextile (Grab Method).

1.04 SUBMITTALS

A. Manufacturer's catalogue sheets and other pertinent information on geotextile fabric.

PART 2 PRODUCTS

2.01 FILTER FABRIC

A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material. Geotextile fabric shall have a grab strength of 100 psi (689.48 kPa) in any principal direction (ASTM D4632/D4632M), Mullen burst strength exceeding 200 psi (1378.95 kPa), and the equivalent opening size between 50 and 140, with the appropriate opening size to be selected based on the grain size characteristics of the disturbed soil. Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six (6) months of expected usable construction life at a temperature range of 0 degrees F up to 120 degrees F. Representative Manufacturers: Mirafi Inc. or preapproved equivalent.

PART 3 EXECUTION

3.01 GENERAL

A. Provide erosion control and sedimentation control systems. Such systems shall be of the type indicated and shall be constructed in accordance with the requirements set out in this Section.

B. No clearing and grubbing or rough cutting shall be permitted until erosion and sedimentation control systems are in place.

C. Regularly inspect and repair or replace components of all erosion and sedimentation control systems as specified for each type of system. Unless otherwise directed, maintain the erosion and sedimentation control systems until the project are stabilization is accepted by the Owner. Remove erosion and sedimentation control systems promptly when directed by the Owner. Discard removed materials as required by these Specifications.

D. Remove and dispose sediment deposits at the project designated spoil site. Sediment shall not be allowed to flush into stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state, and local regulations.

E. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of construction limits. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.

F. Contractor shall employ protective measures described in Section 01 57 00 - Source Control to avoid damage to existing trees to be retained on the project site. Conduct all construction operations under this Contract in conformance with the erosion control practices described in that Section.

3.02 CONSTRUCTION METHODS

A. Filter fabric fence systems shall be installed at work perimeter in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow to be retained and accumulate.

B. Attach the filter fabric to 1 inch (25.4 mm) by 2 inch (50.8 mm) wooden stakes spaced a maximum of 3 feet (91.44 cm) apart and embedded in the ground a minimum of 1 foot (30.48 cm). If factory preassembled fence with support netting is used, spacing of the post may be increased to 8 feet (243.84 cm) maximum. The wooden stakes shall be installed at a slight angle toward the source of anticipated runoff.

C. Trench in the toe of the filter fabric fence with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow or for V-trench configuration as shown on the Detail. Lay filter fabric along the edges of the trench. Backfill and compact trench.

D. Filter fabric shall have a minimum height of 18 inches (457.2 mm) and a maximum height of 36 inches (914.4 mm) above the natural ground.

E. The filter fabric should be provided in continuous rolls and cut to the length of the Silt Fence to minimize the use of joints. When joints are necessary, the fabric should be spliced together only at a support post with a minimum 6 inch (152.4 mm) overlap, and sealed securely.

F. Inspect sediment filter fabric fence systems after each rainfall, daily during periods of prolonged rainfall, and at a minimum once a week. Repair or replace damaged section immediately to restore the requirements of this Section. Remove sediment deposits when silt reaches one-third of the height of the fence in depth or 6 inches (152.4 mm), whichever is less.

3.03 MEASUREMENT AND PARMENT

A. No separate measurement or payment will be made for material and labor performed under this section. Include all costs in the lump sum price, or in the unit price for Storm Water Pollution Prevention Plan.

END OF SECTION 01 57 13

SECTION 01 57 19
CONTROL OF GROUND & SURFACE WATER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations and foundation beds in stable condition, and controlling ground water conditions for tunnel excavations.

B. Protecting work against surface runoff and rising floodwaters.

C. Trapping suspended sediment in the discharge from the surface and ground water control systems.

PART 2 MEASUREMENT AND PAYMENT

2.01 UNIT PRICES

A. Measurement for control of ground water, if included in Bid Form, will be on either a lump sum basis or a linear foot basis for continuous installations of well points, eductor wells, or deep.

B. If not included in Bid Form, include the cost to control ground water in unit price for work requiring such controls.

C. No separate payment will be made for control of surface water. Include cost to control surface water in unit price for work requiring controls.

D. Follow Division 1 for unit price procedures.

E. Stipulated Price (Lump Sum) Contract. If the Contract is a Stipulated Price Contract, include payment for work under this Section in the total Stipulated Price.

2.02 REFERENCES

A. ASTM D698 – Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft3 (600kN-m/m3).

B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

2.03 DEFINITIONS

A. Ground water control system: system used to dewater and depressurize water-bearing soil layers.

2.04 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

1. Dewatering: lowering the water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts; and disposing of removed water. Intent of dewatering is to increase stability of tunnel excavations and excavated slopes, prevent dislocation of materials from slopes or bottoms of excavations, reduce lateral loads on sheeting and bracing, improve excavating and hauling characteristics of excavated material, prevent failure or heaving of bottom of excavations, and to provide suitable conditions of placement of backfill materials and construction of structures and other installations.
2. Depressurization: includes reduction in piezometric pressure within strata not controlled by dewatering alone, necessary to prevent failure or heaving of excavation bottom or instability of tunnel excavations.

C. Excavations drainage: includes keeping excavations free of surface and seepage water.

D. Surface drainage: includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines necessary to protect Work from any source of surface water.

E. Monitoring facilities for ground water control system: includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

2.05 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit proposed method and spacing of readings for review prior to obtaining water level readings.

B. Design ground water control systems, compatible with requirements of Federal Regulations 29 CFR 1926and Division 2 to produce following results:
   1. Effectively reduce hydrostatic pressure affecting:
      a. Excavations.
      b. Tunnel excavation, face stability or seepage into tunnels
   2. Develop substantially dry and stable subgrade for subsequent construction operations.
   3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities and other work.
   4. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata.
   5. Maintain stability of sides and bottom of excavations.

C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.

D. Provide drainage of seepage water and surface water, as well as water from other sources entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.

E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.

F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations. Modify ground water ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site improvements, adjacent property, adjacent water wells, or potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of system to protect property as required.

H. Install an adequate number of piezometers installed at proper locations and depths, necessary to provide meaningful observations of conditions affecting excavation, adjacent structures and other water wells.

I. Install environmental monitoring wells at proper locations and depths necessary to provide adequate observations of hydraulic conditions and possible contaminant transport from contamination sources into work area or ground water control system.

2.06 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit Ground Water and Surface Water Control Plan review by Owner’s Representative prior to start of excavation work. Include the following:
   1. Results of subsurface investigation and description of extent and characteristics of water bearing layers subject to ground water control.
   2. Names of equipment Suppliers and installation Subcontractors.

3. Description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria and operation and maintenance procedures.
4. Description of proposed monitoring facilities indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics.
5. Description of proposed filters including types, sizes, capacities and manufacturer's application recommendations.
6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.
7. Operating requirements, including piezometric control elevations for dewatering and depressurization.
8. Excavation drainage methods including typical drainage layers, sump pump application and other means.
9. Surface water control and drainage installations.
10. Proposed methods and locations for disposing of removed water.

C. Submit following records upon completion of initial installation:
1. Installation and development reports for well points, eductors, and deep wells.
2. Installation reports and baseline readings for piezometers and monitoring wells.
3. Baseline analytical test data of water monitoring wells.
4. Initial flow rates.

D. Submit the following records weekly during control of ground and surface water operations:
1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.02, Requirements for Eductor, Well Points, or Deep Wells.
2. Maintenance records for ground water control installations, piezometers and monitoring wells.

2.07 ENVORONMENTAL REQUIREMENTS

A. Comply with requirements of agencies having jurisdiction.

B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.

C. Obtain necessary permits from agencies with jurisdiction over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Since review and permitting process may be lengthy, take early action to obtain required approvals.

D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

PART 3 PRODUCTS

3.01 EQUIPMENT AND MATERIALS

A. Select equipment and materials necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by Owner's Representative through submittals required in Paragraph 1.06, Submittals.

B. Use experienced contractors, regularly engaged in ground water control system design, installation, and operation, to furnish and install and operate eductors, well points, or deep wells, when needed.

C. Maintain equipment in good repair and operating condition.

D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.

E. Portable Sediment Tank System; Standard 55-gallon steel or plastic drums, free of hazardous material contamination.
   1. Shop or field fabricate tanks in series with main inlet pipe, inter-tank pipes and discharge pipes, using quantities sufficient to collect sediments from discharge water.

PART 4 EXECUTION

4.01 GROUND WATER CONTROL

A. Perform necessary subsurface investigation to identify water bearing layers, piezometric pressures and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine draw down characteristics. Present results in the Ground Water and Surface Water Control Plan submittal.

B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.

C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify Owner's Representative in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.

D. Provide continuous system operation, including nights, weekends, and holidays. Arrange appropriate backup if electrical power is primary energy source for dewatering system.

E. Monitor operations to verify systems lower ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for subsequent construction operations.

F. Depressurize zones where hydrostatic pressure in confined water bearing layers exist below excavations to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in the Ground Water and Surface Water Control Plan.

G. Removal of ground water control installations.
   1. Remove pumping system components and piping when ground water control is no longer required.
   2. Remove piezometers, including piezometers installed during design phase investigations and left for Contractor's use, upon completion of testing, as required in accordance with Part 3 of applicable specification.
   3. Remove monitoring wells when directed by Owner's Representative.
   4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.

H. During backfilling, maintain water level a minimum of 5 feet (152.4 cm) below prevailing level of backfill. Do not allow the water level to cause uplift pressures in excess of 80 percent of downward pressure produced by weight of structure of backfill in place. Do not allow water levels to rise into cement-bentonite grout or cement-sand grout until at least 48 hour after placement.

I. Provide uniform pipe diameter for each pipe drain run constructed for dewatering. Remove pipe drains when no longer required. If pipe removal is impractical, grout connections at 50- foot drains and fill pipe with cement-bentonite grout or cement-sand grout after removal from service.

J. The extent of ground water control for structures with permanent perforated underground drainage systems may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide a means to drain affected portions of underground systems, including standby equipment. Maintain drainage systems during construction operations.

K. Remove systems upon completion of construction of when dewatering and control of surface or ground water is no longer required.

L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D698.

M. Foundation Slab: Maintain saturation line at least 3 feet (91.44 cm) below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

4.02 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

A. For above ground piping in ground water control systems, include a 12-inch minimum length of clear, transparent piping between each eductor well or well point and discharge header to allow visual monitoring of discharge from each installation.

B. Install sufficient piezometers or monitoring wells to show that trench or shaft excavations in water bearing materials are pre-drained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring for depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of work.

C. Install piezometers or monitoring wells at least one week in advance of the start of associated excavation.

D. Dewatering may be omitted for portions of under drains or other excavations, where auger borings and piezometers or monitoring wells show that soil is pre-drained by existing systems and that ground water control plan criteria are satisfied.

E. Replace installations that produce noticeable amounts of sediments after development.

F. Provide additional ground water control installations, or change method of control if, ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specifications. Submit revised plan according to Paragraph 1.6B.

4.03 SEDIMENT TRAPS

A. Install sediment tank as shown on approved plan.

B. Inspect daily and clean out tank when one-third of sediment tank is filled with sediment.

4.04 SEDIMENT SUMP PIT

A. Install sediment sump pits as shown on approved plan.

B. Construct standpipe by perforating 12 inch (304.8 mm) to 24 inch (609.6 mm) diameter corrugated metal or PVC pipe.

C. Extend standpipe 12 inches (304.8 mm) to 18 inches (457.2 mm) above lip of pit.

D. Convey discharge of water pumped from standpipe to sediment trapping device.

E. Fill sites of sump pits, compact to density of surrounding soil and stabilize surface when construction is complete.

4.05 EXCAVATION DRAINAGE

A. Use excavation drainage methods if well-drained conditions can be achieved. Excavation drainage may consist of layers of crushed stone and filter fabric, and sump pumping, in combination with sufficient ground water control wells to maintain stable excavation and backfill conditions.

4.06 MAINTENANCE AND OBSERVATION

A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage is operating at the site, or water is seeping into tunnels, and maintain systems in good operating condition.

B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedules.

C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make specified observations.

D. Remove and grout piezometers inside or outside of excavation area when ground water control operations are complete. Remove and grout monitor wells when directed by Owner's Representative.

4.07 MONITORING AND RECORDING

A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also, monitor and record water level an ground water recovery. Record observations daily until steady conditions are achieved and twice weekly thereafter.

B. Observe and record elevation of water level daily as long as ground control system is in operation, and weekly thereafter until Work is completed or piezometer of wells are removed, except when Owner's Representative determines more frequent monitoring and recording are required. Comply with Owner's Representative's direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

4.08 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavation through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirements includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by agencies.

END OF SECTION 01 57 19

SECTION 01 57 23
TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Implementation of Storm Water Pollution Prevention Plans (SWP3) described in Division 1.

B. Installation and maintenance of storm-water pollution prevention structures: diversion dikes, interceptor dikes, diversion swales, interceptor swales, downspout extenders, pipe slope drains, paved flumes and level spreaders. Structures are used during construction and prior to the final development of the site.

C. Filter Fabric Fences:
   1. Type 1: Temporary filter fabric fences for erosion and sediment control in non-channelized flow areas.
   2. Type 2: Temporary reinforced filter fabric fences for erosion and sediment control in channelized flow areas.

D. Straw Bale Fence.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

C. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus; 2021.

D. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2022.

E. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a (Reapproved 2023).

F. ASTM D4833/D4833M - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products; 2007 (Reapproved 2020).

G. D 6382 – Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.

1.03 MEASUREMENT AND PAYMENT

A. UNIT PRICES
   1. Payment for all SWP3 item are on a lump sum basis.

B. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.04 SYSTEM DESCRIPTIONS

A. Filter Fabric Fence Type 1 and Type 2: Install to allow surface or channel runoff percolation through fabric in sheet-flow manner and to retain and accumulate sediment. Maintain Filter Fabric Fences to remain in proper position and configuration at all times.

B. Interceptor Dikes and Swales: Construct to direct surface or channel runoff around the project area runoff from project area into sediment traps.

C. Drop Inlet Baskets: Install to allow runoff percolation through the basket and to retain and accumulate sediment. Clean accumulation of sediment to prevent clogging and backups.

D. Sediment Traps: Construct to pool surface runoff from the construction area to allow sediment to settle onto the bottom of the trap.

1.05 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit manufacturer's catalog sheets and other product data on geotextile or filter fabrics, outlet pipe, perforated riser and connectors.

D. Submit proposed methods, equipment, materials, and sequence of operations for storm-water pollution prevention structures.

E. Submit shop drawings for Drop Inlet Baskets.

PART 2 PRODUCTS

2.01 CONCRETE

A. Concrete: Class B in accordance with Division 32 or as shown on the Drawings.

2.02 AGGREAGATE MATERIALS

A. Use poorly graded cobbles with a diameter greater than 2 inches (50.8 mm) and less than 5 inches (127 mm).

B. Provide gravel lining in accordance with Division 31 or as shown on the Drawings.

C. Provide clean cobble and gravel consisting of crushed concrete or stone. Use clean, hard crushed concrete or stone free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic matter.

D. Sediment Pump Pit Aggregate: Use nominal 2-inch diameter river gravel.

2.03 PIPE

A. Polyethylene culvert pipe or PVC sewer pipe in accordance with Division 33 or as shown on the Drawings.

B. Inlet Pipes: Galvanized steel pipe in accordance with Division 33 or as shown on the Drawings.

C. Standpipe for Sediment Pump Pits: Galvanized round culvert pipe or round PVC pipe, minimum of 12-inch and a maximum of 24-inch diameter, perforated at 6 to 12-inch centers around circumference.

2.04 GEOTEXTILE FILTER FABRIC

A. Woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of the longest practical length.

B. Grab Strength: 100 psi (689.48 kPa) in any principal direction (ASTM D-4632), Mullen burst strength >200 psi (1378.95 kPa), and equivalent opening size between 50 and 140.

C. Furnish ultraviolet inhibitors and stabilizers for minimum 6 months of expected usable construction life at temperature range of 0 degrees Fahrenheit (-17.78 degrees Celsius) to 120 degrees F.

D. Mirafi, Inc., Synthetic Industries, or equivalent.

2.05 FENCING

A. Wire Fencing: Woven galvanized steel wire, 14 gauge by 6-inch square mesh spacing, minimum 24-inch roll or sheet width of longest practical length.

B. Fence Stakes: Nominal 2 x 2 inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top; length as required for minimum 12 inch bury and full height of filter fabric.

2.06 SANDBAGS

A. Provide woven material made of polypropylene, polyethylene, or polyamide material.
   1. Minimum unit weight of four ounces per square yard.
   2. Minimum grab strength of 100 psi (689.48 kPa) in any principal direction (ASTM D4632/D4632M).
   3. Mullen burst strength exceeding 300 psi (2068.43 kPa).
   4. Ultraviolet stability exceeding 70 percent.

5. Size: Length: 18 to 24 inches (609.6 mm). Width: 12 to 18 inches (457.2 mm). Thickness: 6 to 8 inches (203.2 mm). Weight: 50 to 125 pounds.

2.07 DROP INLET BASKET

A. Provide steel frame members in accordance with ASTM A36.

B. Construct top frame of basket with two short sides of 2 inch (50.8 mm) by 2 inch and single long side of 1 inch by 1 inch, 1/8 inch (3.18 mm) angle iron. Construct basket hangers of 2 inch by ¼ inch iron bars. Construct bottom frame of 1 inch by ¼ inch iron bar or ¼ inch plate with center 3 inches (76.2 mm) removed. Use minimum ¼ inch diameter iron rods or equivalent for sides of inlet basket. Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

PART 3 EXECUTION

3.01 PREPARATION, INSTALLATION AND MAINTENANCE

A. Provide erosion and sediment control structures at locations shown on the Drawings.

B. Do not clear, grub or rough cut until erosion and sediment control systems are in place unless approved by Project Manager to allow installation of erosion and sediment control systems, soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within the project site until acceptance of the Project or until directed by the Project Manager to remove and discard the existing system.

D. Regularly inspect and repair or replace damaged components of erosion and sediment control structures. Unless otherwise directed, maintain erosion and sediment control structure until project area stabilization is accepted. Re-dress and replace granular fill at outlets as needed to replenish depleted granular fill. Remove erosion and sediment control structures promptly when directed by the Project Manager. Dispose of materials in accordance with Division 1.

E. Remove and dispose of sediment deposits at the designated spoil site for the Project. If a project spoil site is not designated on Drawings, dispose of sediment off-site at an approved location in accordance with Division 1.

F. Unless otherwise shown on the Drawings, compact embankments, excavations, and trenches in accordance with Division 1.

G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated right of way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control structures.

H. Protect existing trees and plants in accordance with Division 1.

3.02 SEDIMENT TRAPS

A. Install sediment traps so that surface runoff shall percolate through systems in sheet flow fashion and allow retention and accumulation of sediment.

B. Inspect sediment traps after each rainfall, daily during periods of prolonged rainfall, and at a minimum once each week. Repair or replace damaged section immediately.

C. Use fill material for embankment in accordance with Division 31.

D. Excavation length and height shall be as specified on Drawings. Use side slopes 2:1 or flatter.

E. Stone outlet sediment traps:

1. Maintain a minimum of 6 inches (152.4 mm) between top of core material and top of stone outlet, minimum of 4 inches (101.6 mm) between bottom of core material and existing ground and minimum of 1 foot (30.48 cm) between top of stone outlet and top of embankment.

2. Embed cobbles minimum of 4 inches (101.6 mm) into existing ground for stone outlet. Core shall be a minimum of 1 foot (30.48 cm) in height and in width and wrapped in triple layer of geotextile filter fabric.

F. Sediment Basin with Pipe Outlet Construction Methods: Install outlet pipe and riser as shown on the Drawings.

G. Remove sediment deposits when design basin volume is reduced by one-third or sediment level is one foot below principal spillway crest, whichever is less.

3.03 FILTER FABRIC FENCE CONSTRUCTION METHODS

A. Fence Type 1
1. Install stakes 6 feet (182.88 cm) on center maximum and firmly embed minimum 12 inches (304.8 mm) in soil. If filter fabric is factory pre-assembled with support netting, then maximum support spacing is 8 feet (243.84 cm). Install wood stakes at a slight angle toward the source of anticipated runoff.
2. Trench in the toe of the fence lines so the downward face of the trenches is flat and perpendicular to direction of flow. V-trench Configuration as shown on Drawings may also be used.
3. Lay fabric along edges of trenches in longest practical continuous runs to minimize joints. Make joints only at a support post. Splice with minimum 6-inch overlap and seal securely.
4. Staple filter fabric to stakes at maximum 3 inches (76.2 mm) on center. Extend fabric minimum 18 inches (457.2 mm) and maximum 36 inches (914.4 mm) above natural ground.
5. Backfill and compact trench.

B. Fence Type 2
1. Layout fence same as for Type 1.
2. Install stakes at 6 feet (182.88 cm) on center maximum and at each joint in wire fence, firmly embedded 1-foot minimum, and inclined it as for Type 1.
3. Tie wire fence to stakes with wire at 6 inches (152.4 mm) on center maximum. Overlap joints minimum one bay of mesh.
4. Install trench same as for Type 1.
5. Fasten filter fabric wire fence with tie wires at 3 inches (76.2 mm) on center maximum.
6. Layout fabric same as for Type 1. Fasten to wire fence with wire ties at 3 inches (76.2 mm) on center maximum and, if applicable, to stakes above top of wire fence it as for Type 1.
7. Backfill and compact trench.

C. Attach filter fabric to wooden fence stakes spaced a maximum of 6 feet (182.88 cm) apart or steel fence stakes spaced a maximum of 8 feet (243.84 cm) apart and embedded a minimum of 12 inches (304.8 mm). Install stakes at a slight angle toward the source of anticipated runoff.

D. Trench in toe of filter fabric fence with spade or mechanical trencher so that downward face of trench is flat and perpendicular to direction of flow. A V-trench configuration may also be used. Lay filter fabric along edges of trench. Backfill and compact trench upon completion of Construction.

E. Filter fabric fence shall have a minimum height of 18 inches (457.2 mm) and a maximum height of 36 inches (914.4 mm) above natural ground.

F. Cut the length of the fence to minimize the use of joints. When joints are necessary, splice fabric together only at support post with minimum 6-inch overlap and seal securely.

G. Triangular Filter Fabric Fence Construction Methods:
1. Attach filter fabric to wire fencing,18 inches on each side. Provide a fabric cover and skirt with continuous wrapping of fabric. Skirt should form a continuous extension of fabric on the upstream side of the fence.
2. Secure triangular fabric filter fence in place using one of the following methods:
   a. Toe-in skirt 6 inches (152.4 mm) with mechanically compacted material;

b. Weight down skirt with continuous layer of 3-inch to 5-inch graded rock; or
c. Trench-in entire structure 4 inches (101.6 mm).

3. Anchor triangular fabric fence structure and skirt securely in place using 6-inch wire staples on 2-foot centers on both edges and on skirt, or staked using 18-inch by 3/8-inch diameter re-bar with tee ends.
4. Lap fabric filter material by 6 inches (152.4 mm) to cover segment joints. Fasten joints with galvanized shoat rings.

H. Reinforced Filter Fabric Barrier Construction Methods:
1. Attach woven wire fence stakes.
2. Securely fasten filter fabric material to wire fence with tie wires.
3. When used in swales, ditches or diversions, elevation of barrier at top of filter fabric at flow line location in channel shall be lower than bottom elevation of filter fabric at ends of barrier or top of bank, whichever is less, in order to keep stormwater discharge in channel from overtopping bank.
4. Remove sediment deposits when silt reaches depth one-third height of barrier or 6 inches (152.4 mm), whichever is less.

3.04 DIKE AND SWALE

A. Unless otherwise indicated, maintain minimum dike height of 18 inches (457.2 mm), measured from cleared ground at upslope toe to top of dike. Maintain side slopes of 2:1 or flatter.

B. Dike and Swale Stabilization: When shown on the Drawings, place gravel lining 3 inches (76.2 mm) thick and compacted into the soil or 6 inches (152.4 mm) thick if truck crossing is expected. Extend gravel lining across bottom and up both sides of swale minimum height of 8 inches (203.2 mm) vertically, above bottom. Gravel lining on dike side shall extend up the upslope side of the dike a minimum height of 8 inches, measured vertically from the interface of existing or graded ground and upslope toe of dike, as shown on Drawings.

C. Divert flow from dikes and swales to sediment basins, stabilized outlets, or sediment trapping devices of types and at locations shown on Drawings. Grade dikes and swales as shown on Drawings, or, if not specified, provide positive drainage with a maximum grade of 1 percent to outlet or basin.

D. Clear in accordance with Division 31.

E. Carry out excavation for swale construction so that erosion and water pollution is minimal. Minimum depth shall be 1 foot (30.48 cm) and bottom width shall be 4 feet (121.92 cm), with level swale bottom. Excavations slopes shall be 2:1 or flatter. Clear, grub and strip excavations area of vegetation and root material.

3.05 DOWN SPOUT EXTENDER

A. Downspout extender shall have a slope of approximately 1 percent. Use pipe diameter of 4 inches (101.6 mm) or as shown on the Drawings. Place pipe in accordance with Division 33.

3.06 PIPE SSLOPE DRAIN

A. Compact soil around and underdrain entrance section to top of embankment in lifts appropriately sized for method of compaction utilized.

B. Inlet pipe shall have a slope of 1 percent or greater. Use pipe diameter as shown on the Drawings.

C. Top of embankment over inlet pipe and embankments directing water to pipe shall be at least 1 foot (30.48 cm) higher at all points.

D. Pipe shall be secured with hold-down grommets spaced 10 feet (304.8 cm) on centers.

E. Place riprap apron with a depth equal to pipe diameter with 2:1 side slope.

3.07 PAVED FLUME

A. Compact soil around and under the entrance section to the top of the embankment in lifts appropriately sized for method of compaction utilized.

B. Construct subgrade to required elevations. Remove and replace soft sections and unsuitable material. Compact subgrade thoroughly and shape to a smooth, uniform surface.

C. Construct permanent paved flumes in accordance with Drawings.

D. Remove sediment from riprap apron when sediment has accumulated to a depth of one foot.

3.08 LEVEL SPREADER

A. Construct level spreader on undisturbed soil and not on fill. Ensure that spreader lip is level for uniform spreading of storm runoff.

B. Maintain at required depth, grade, and cross-section as specified on Drawings. Remove sediment deposits as well as projections or other irregularities which will impede normal flow.

3.09 INLET PROTECTION BARRIER

A. Place sandbags and filter fabric fences at locations shown on the SWP3.

3.10 DROP INLET CONSTRUCTION METHODS

A. Fit inlet insert basket into inlet without gaps around insert at locations shown on the SWP3.

B. Support for inlet insert basket shall consist of fabricated metal as shown on Drawings.

C. Push down and form filter fabric to shape of basket. Use a sheet of fabric long enough to be supported by basket frame when holding sediment and extend at least 6 inches (152.4 mm) past frame. Place inlet grates over basket/frame to serve as fabric anchor.

D. Remove sediment deposits after each storm event and whenever accumulation exceeds 1-inch depth during weekly inspections.

3.11 BRUSH BERM CONSTRUCTION METHODS

A. Construct brush berm along contour lines by hand placing method. Do not use machine placement of brush berm.

B. Use woody brush and branches having a diameter less than 2 inch (50.8 mm) with 6 inch (152.4 mm) overlap. Avoid incorporation of annual weeds and soil into brush berm.

C. Use minimum height of 18-inches measured from top of existing ground at upslope toe to top of berm. Top width shall be 24 inches (609.6 mm) minimum and side slopes shall be 2:1 or flatter.

D. Embed brush berm into the soil a minimum of 4-inches and anchor using wire, nylon or polypropylene rope across berm with a minimum tension of 50 pounds. Tie rope securely to 18-inch x 3/8-inch diameter rebar stakes driven into the ground on 4-foot centers on both sides of the berm.

3.12 STREET AND SIDEWALK CLEANING

A. Keep areas clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exists at construction, staging, storage, and disposal areas, following Division 1.

B. In addition to stabilized construction access points, shovel or sweep pavements as required to keep areas clean. Do not water hose or sweep debris and mud off into adjacent areas, except, hose sidewalks during off-peak hours, after sweeping.

3.13 WASTE COLLECTION AREAS

A. Prevent water runoff from passing through waste collection areas, and prevent water runoff from waste collection areas migrating outside collection areas.

3.14 EQUIPMENT MAINTENANCE AND REPAIR

A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose, so fuels, lubricants, solvents, and other potential pollutants are not washed directly into receiving streams or stormwater conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid and solid waste. Clean and inspect maintenance areas daily.

B. Where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

3.15 VEHICLE/ EQUIPMENT WASHING AREAS

A. Install wash area (stabilized with coarse aggregate) adjacent to stabilized construction exit(s), as required to prevent mud and dirt run-off. Release wash water into drainage swales or inlets protected by erosion and sediment controls. Build wash areas following Division 1. Install gravel or rock base beneath wash areas.

B. Wash vehicles only at designated wash areas. Do not wash vehicles such as concrete delivery trucks or dump trucks and other construction equipment at locations where runoff flows directly into watercourse or stormwater conveyance systems.

C. Locate wash areas to spread out and evaporate or infiltrate wash water directly into the ground, or collect runoff in temporary holding or seepage basins.

3.16 WATER RUNOFF AND EROSION CONTROL

A. Control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.

B. Control fill, grading and ditching to direct water away firm excavations, pits, tunnels, and other construction areas, and to direct drainage to proper runoff courses to prevent erosion, sedimentation or damage.

C. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.

D. Dispose of drainage water to prevent flooding, erosion, or other damage to the site or adjoining areas. Follow environmental requirements.

E. Retain existing drainage patterns external to the site by constructing temporary earth berms, sedimentations basins, retaining areas, and temporary ground cover as required to control conditions.

F. Plan and execute construction and earthwork to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
   1. Hold area of bare soil exposed at one time to a minimum.
   2. Provide temporary controls such as berms, dikes, and drains.

G. Construction fill and waste areas by selective placement to eliminate surface silts or clays which will erode.

H. Inspect earthwork periodically to detect the start of erosion. Immediately apply corrective measures as required to control erosion.

I. Dispose of sediments offsite, not in or adjacent to streams or floodplains, nor allow sediments to flush into streams or drainage ways. Assume responsibility for offsite disposal location.

J. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soil in a maximum of 8-inch layers. Provide compaction density at a minimum of 90 percent Standard Proctor ASTM D698-78 density. Make at least one test per 500 cubic yards of embankment.

K. Do not maneuver vehicles on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sedimentation control systems caused by construction traffic.

L. Do not damage existing trees intended to remain.

3.17 REMOVAL OF CONTROLS

A. Remove erosion and sediment controls when the site is finally stabilized or as directed by the Owner’s Representative.

B. Dispose of sediments and waste products following Division 1.

END OF SECTION 01 57 23

SECTION 01 60 00
MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 QUALITY ASSURANCE

A. Compatibility: When given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods to prevent damage, deterioration and loss, including theft.
   1. Schedule delivery to minimize storage at the site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation to ensure minimum holding time for items that are flammable, hazardous, easily damaged or sensitive to deterioration, theft and other losses.
   3. Deliver products to the site in the manufacturer's original sealed containers or other packing system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
   4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
   5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
   6. Store heavy materials in a manner that will not endanger supporting construction.
   7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 PRODUCTS

2.01 PRODUCT SELSECTION

A. General Requirements: Provide products complying with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
   1. Provide products complete with all accessories, trim, finish and other items needed for a complete installation and for the intended use and effect.
   2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures:
   1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated; no substitutions permitted.
   2. Semi-proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated; no substitutions will be permitted. Where products or manufacturers are specified by name, accompanied by the term "or equal", or a similar term, submit evidence as specified below under Substitutions.
   3. Non-proprietary Specifications: When Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Substitutions requirements below to obtain approval for use of an unnamed product.
   4. Descriptive Specification Requirements: Where specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristic and otherwise complies with Contract requirements.

5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance is implied where the product is specified for a specific application. Manufacturer's recommendations may be in published literature or by the manufacturer's certification or performance.
6. Codes and Standards: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, code or regulations specified.
7. Visual Matching: Where Specifications require matching an established Sample, Architect's decision on whether match is satisfactory will be final.
8. Visual Selection: Where specified requirements include the phrase "as selected from manufacturer's standard colors and patterns" or similar clause, select products and manufacturers complying with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.
9. Substitutions: Substitutions will only be considered when specified materials are no longer available, no longer meet code requirements, or equivalent materials will save the Owner significant amount of money.

C. Substitutions: For proposed substitutions, submit evidence for review by Architect, who shall be the sole judges of equivalency, that such products are equivalent in every significant way to those specified; indicate cost savings. Bear responsibility for all costs incurred in coordinating and modifying other work to accommodate substitutions.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

3.02 CLEANING

A. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01 60 00

SECTION 01 72 00
COMMON EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. General installation of products.
   4. Coordination of Owner-installed products.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.
   8. Correction of the Work.

B. Related Sections include the following:
   1. Division 01 Section “Cutting and Patching” for procedural requirements for cutting and patching necessary for the installation of performance of other components of the Work.
   2. Division 01 Section “Closeout Procedures” for submittal final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION

A. Existing Conditions: Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
   1. Before construction, verify the location and points of connection of utility services.
   2. Existing Utilities: Locate underground utilities.

3.02 PREPARATION

A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner, in writing, not less than five days in advance of proposed utility interpretations.
   2. Do not proceed with utility interruptions without Owner’s written permission.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to the other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit request on “Request for Interpretation” form included at the end of Section 01 26 13.

3.03 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated:

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, comply with provisions of Section 01 31 06. Install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
1. Mounting Heights: Where mounting heights are not indicated, requires clarification and mount components at heights directed by Architect.

H. Joint: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.04 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operation of the Work with work performed by Owner's construction forces, AV, IT, etc.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timeable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.05 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241for removal of combustible waste materials and debris.
2. Assure there are no significant food matters in dumpster.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.

2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposure: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.06 STARTING AND ADJUSTING

A. Manufacturer’s representative shall be present for initial start up.

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust operating components for proper operating without binding. Adjust equipment for proper operation.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer’s Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section “Quality Requirements”.

3.07 PROTECTOIN OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damaged or deterioration at time of Substantial Completion.

B. Comply with manufacturer’s written instructions for temperature and relative humidity.

3.08 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section “Cutting and Patching”.
1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 72 00

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 GENERAL

1.01 GENERAL DESCRIPTION OR WORK OF THIS SECTION

A. Section Includes: Procedures for cutting, patching, removal, replacing and refinishing necessitated by damage to or deterioration of installed work, cutting and removal for access or inspection and similar causes.

1.02 QUALITY ASSURANCE

A. Perform cutting, patching, removal, replacement, and refinishing work so as to preserve the aesthetic and structural integrity, continuity and uniformity of materials and construction.

PART 2 PRODUCTS

2.01 CUTTING

A. Neatly cut materials to be removed, leaving a clean edge on adjacent material to remain. Break out material to be removed carefully so irregular edges or surfaces will not be visible after repair, patching and/or replacement and completion of construction.

B. Unfasten and dismantle assembled systems wherever possible at joints between components. Remove components in complete pieces, cutting only where unavoidable.

C. Structural Elements: if removal or alteration becomes necessary, perform such removal or alteration only upon written approval of the Architect and Owner.

2.02 PATCHING, REAPAIRING AND REFINISHING

A. Promptly repair, patch and/or replace items or materials damaged by construction operations in compliance with applicable requirements of this Section covering the work to be performed and the requirements of this Section, at no additional cost to the Owner.

B. Repair damaged areas exposed to view in ceilings, walls, floors and other exposed surfaces of all finished spaces. Match adjacent like materials and finish.

C. Interior penetration holes in walls, ceilings, and floors of unfinished spaces and spaces not exposed to view shall be grouted or filled and sealed with approved materials as required for sound sealing and firestops where required.

END OF SECTION 01 73 29

SECTION 01 74 16
SITE MAINTENANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Restoration of site affected by the Work in public or private property, including pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.02 MEASUREMENT AND PAVEMENT

A. Unit Prices.
   1. No separate payment made for site restoration. Include cost in appropriate work section.
   2. Refer to Division 1 for Unit Price procedures.

B. Stipulated Price (Lump Sum) Contracts. If Contract is Stipulated Price Contract, include payment for work under this Section in total Stipulated Price.

1.03 DEFINITIONS

A. Phase: Locations identified on the plans and listed in Division 1.

B. Site Restoration: Replacement or reconstruction of Site Improvements located in rights-of-way, easements, public property, and private property affected or altered by the Work.

C. Site Improvement: Includes pavement, curbs, and gutters, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, landscaping, and other improvements in existence at the Project site before commencement of construction operations.

1.04 SUBMITTALS

A. Conform to requirements of Division 1.

B. Schedule of testing, service connections, abandonment, backfill, and site restoration.

C. Sample of notices to residents outlining their responsibility for maintenance of site improvements adjacent to the Project that are not disturbed by construction operations.

1.05 SCHEDULING

A. Schedule testing, service connections, abandonment, backfill and site restoration immediately following completion of work in an area.

B. Phased Construction:
   1. Commencement of subsequent Phase will follow scheduling of site restoration of prior Phase. Limit work to a maximum of two Phases of the project.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pavement, Sidewalks and Driveways: Materials specified in Division 32.

B. Seeding and Sodding: Sod specified in Division 32.

C. Trees, Shrubs and Plantings: Conform to requirements of Division 1.

PART 3 EXECUTION

3.01 SITE PROJECTS

A. Contractor shall maintain a clean and orderly site throughout construction duration. Work includes but is not limited to: insuring grass is mowed and kept at a manageable height, trash is continuously picked up and construction materials are stored in an orderly fashion.

B. Contractor shall immediately repair and restore any damage done to adjoining properties such that final conditions are as equal to as or better than prior to damage occurring.

3.02 WORK IN PUBLIC ROW

A. Contractor shall repair replace any damaged items in the Public ROW to the satisfaction of the local governing authority.

3.03 CLEANING

A. Remove debris and trash to maintain a clean and orderly site in accordance with requirements of General Conditions and Division 1.

3.04 LANDSCAPING AND FENCES

A. Seeding and Sodding.
   1. Remove construction debris and level area with bank sand so that new grass surface matches level of existing grass and maintains pre-construction drainage patterns. Level and fill minor ruts or depressions caused by construction operations with bank sand, where grass is still viable.
   2. Restore previously existing turfed areas with sod and fertilize in accordance with Division 32. Sod to match existing turf.
   3. Restore unpaved areas not requiring sodding with hydromulch seeding conforming to Division 32.

B. Trees, Shrubbery and Plants.
   1. Remove and replant trees, shrubs, and plants in accordance with requirements of Division 1.

C. Fence Replacement.
   1. Replace removed or damaged fencing to equal or better condition than existing prior to construction, including concrete footings and mow strips. Provide new wood posts, top and bottom railing and panels. Metal fencing material, not damaged by the Work, may be reused.
   2. Remove and dispose of damaged or substandard material.

3.05 MAINTENANCE

A. Maintain shrubs, plantings, sodded areas and seeded areas.

B. Replace shrubs, plantings and seeded or sodded areas that fail to become established.

C. Refer to Division 1 for maintenance requirements.

END OF SECTION 01 74 16

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposal of waste material and salvageable material.

1.02 SUMITTALS

A. Conform to requirements of Division 1.

B. Contractor shall obtain all required permits prior to disposal of excess material in areas designated as being in “100-year Flood Hazard Area”.

C. Obtain and submit disposal permits for proposed disposal sites, if required by local ordinances.

D. Submit copy of written permission from property owner, with description of property, prior to disposal of excess material adjacent to Project. Submit written and signed release from property owner upon completion of disposal work.

E. Describe waste materials expected to be stored on-site and a description of controls to reduce Pollutants form these materials, including storage practices to minimize exposure of materials to storm water; and spill prevention and response measures in the Project’s Storm Water Pollution Prevention Plan (SWPPP). Refer to Division 1.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

B. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or other base and surfacing material designated for salvage into Owner’s designated trucks.

C. Pipe Culvert: Load culverts designated for salvage into Owner’s designated trucks.

D. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

E. Coordinate loading of salvageable material on Owner’s trucks with Owner’s Representative.

F. The Contractor shall dispose of all items the Owner refuses in conformance with the requirements of Division 1 at no additional cost to the Owner.

3.02 EXCESS MATERIAL

A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess oil, and other materials not designated for salvage from job site.

B. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner. See paragraph 1.02 D above.

C. Verify flood plain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year Flood Hazard Area unless a permit has been obtained. Remove excess material placed in “100-year Flood Hazard Area” without a permit, at no additional cost to the Owner.

D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

END OF SECTION 01 74 19

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 GENERAL

A. This section outlines procedures to be followed upon conclusion of the Work for closing out the Construction Contract and supplements the provisions of the modified AIA General Conditions AIA A201.

B. Refer to Construction Contract Close Out Checklist, of this Section, for additional requirements.

C. Refer to Division 21 through 28 for additional close out documentation required under those Divisions.

1.02 SUBSTANTIAL COMPLETION, FINAL COMPLETION AND FINAL PAYMENT

A. The final procedure for establishing Substantial Completion is described in paragraph 9.8 of the AIA General Conditions and in the Supplementary Conditions.

B. The procedure for establishing Final Completion and Final Payment, including items to be submitted are described in subparagraphs 9.10.1 through 9.10.5 of the AIA General Conditions and in the Supplementary Conditions.

1.03 FINAL CLEANING

A. Ongoing cleaning during construction is required by General Conditions; see TEMPORARY FACILITIES.

B. Cleaning: employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit. Comply with manufacturer's instructions. Clean building before walk-through.

C. Complete the following cleaning before requesting inspection for Certificate of Substantial Completion.
   1. Remove labels that are not permanent labels.
   2. Clean transparent materials, including mirrors and doors and window glazing. Remove glazing compound and other noticeable materials. Replace chipped, scratched, broken and otherwise damaged materials.
   3. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
   4. Wipe surfaces of mechanical and electrical equipment. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
   5. Clean the site of rubbish, litter and other foreign substances. Sweep areas broom clean; remove stains, spills and other foreign deposits.

D. Removal Protection: Remove temporary barriers and devices installed to protect Work during construction.

E. Comply with regulations of governing authorities. Do not burn waste materials. Do not bury debris or excess materials on the Owner’s property. Do not discharge harmful or dangerous materials into drains. Remove waste materials from the site and dispose of legally.
   1. Where extra materials of value remaining after completion of Work have become the Owner’s property, arrange for disposition as directed.

PART 2 PRODUCTS

2.01 FORMS

A. The following forms, some of which are included herein, shall be submitted to the Architect during the construction contact close out process.
   1. Contractor's Affidavit of Payment of Debts and Claims
   2. Contractor's Affidavit of Payment of Release of Liens
   3. Consent of Surety to Final Payment
   4. General Contractor Affidavit and Release
   5. Subcontractor/Supplier Affidavit and Release
   6. General Contractor Guarantee
   7. Subcontractor Guarantee
   8. General Contractor Hazardous Material Certificate
   9. Subcontractor/Supplier Hazardous Material Certificate
   10. Dumpster Permits
   11. Flame Spread Certificates for all required materials specified throughout Project Manual
   12. Certificates for Finished Floor Elevations issued by a Registered Texas Surveyor in good standing.
   13. City Certificate of Occupancy
   14. "Project Close-out" Form at the end of this Section.

B. Use only the enclosed forms. Additional forms are available from the Architect.

2.02 PROJECT CLOSE OUT MANUAL

A. The Contractor shall assemble and deliver to the Architect two (2) complete hard and digital copies of the Project Close Out Manual consisting of the documents listed below and others as may be required under other sections of the Project Manual. Manual shall be constructed of a good quality vinyl 3-ring binder with all pages 8-1/2" x 11". Digital copies shall be on a thumb drive.

B. First sheet shall identify the project, Owner, Architect, Architect's project number, Consultants and Contractor. Provide company name, address telephone number and contact representative for each.

C. Subsequent pages shall include the Table of Contents as included herein and all project data included in the Table of Contents. Provide identifying tabs between all sections.

PART 3 EXECUTION

3.01 CLOSE OUT CHECKLIST

A. The construction Contract Close Out Checklist included herein recaps the major items to be addressed during the close out process. This list is to be used by the Architect and Contractor.

CONSTRUCTION CONTRACT CLOSE OUT MANUAL TABLE OF CONTENTS

Section 1 Contractor's Affidavit of Payment of Debts and Claims (AIA G706A)

Section 2 Contractor's Affidavit of Release of Liens ((()))

Section 3 Consent of Surety to Final Payment (((AIA G707)))

Section 4 Certificate of Substantial Completion (((AIA G704)))

Section 5 General Contractor Affidavit ad Release

Section 6 Subcontractor/Supplier Affidavit and Release (from each subcontractor and supplier)

Section 7 General Contractor Guarantee

Section 8 Subcontractor Guarantee (from each subcontractor)

Section 9 List of Final Subcontractors/Suppliers

Section 10 Manufacturer's Guarantees and extended service contracts

Section 11 General Contractor Hazardous Material Certificate

Section 12 Subcontractor/Supplier Hazardous Material Certificate

Section 13 Extra Stock Verifications:

1. Carpet and Resilient Flooring

A. Acoustic Ceiling
   1. Ceramic Tile
   2. Any other as specified or indicated in Contract Documents

Section 14 Demonstration Verification:

1. Electrical Systems

B. Plumbing Systems
   1. Mechanical System
   2. Audio/Video Systems
   3. Fire Alarm/Suppression Systems
   4. PA Systems
   5. Any other as specified or indicated in the Contract Documents

Section 15 Operating, Maintenance, Cleaning Instruction (identify subcontractor/supplier for each):

1. Ceramic Tile, Carpet
2. Acoustical Wall Panels
3. Restroom Compartments, Washroom Accessories
4. Louvers
5. Any other as specified or indicated in the Contract Documents

Section 16 Keys and Special Tools

Section 17 Certificates of Inspection, Testing and Approval

1. Certificate of Occupancy
2. Notice of termination (NOT) for NPDES Pollution Prevention Plan PPP
3. Health Department Certification
4. Water/Wastewater Authority Certification
5. Fire Marshall Certification
6. State of Texas Boiler Operating Permit
7. Others as may be specified by Contract Documents

Section 18 Serial Numbers

1. Appliances
2. Sound/Communication Equipment
3. Lighting Control Equipment
4. Any other equipment with serial numbers as provided

Section 19 Miscellaneous

1. As-Built (Record Drawings) underground utility drawings showing specific locations of all underground utilities (AutoCAD & Adobe Acrobat Newest Version).
2. As-Built (Record Drawings) (3) digital devices containing all of the electronic drawings showing all changes made during bidding and construction. All changes shall be clouded

and clearly identified. Coordinate with the Architect (AutoCAD & Adobe Acrobat Newest Versions).

3. One full size set of complete As-Built (Record) paper drawings for Owner.

GENERAL CONTRACT AFFIDAVIT AND RELEASE

STATE OF TEXAS **PROJECT: FIRE STATION #42**
OWNER: HAYS CO. ESD #4
COUNTY OF _____ **ARCHITECT: MARTINEZ ARCHITECTS, LP**

3.01 KNOW ALL MEN BY THESE PRESENTS:

A. _____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the contractor who constructed the project referenced above, and that he is duly authorized to make this General Contractor Affidavit and Release.
2. That to the best of his knowledge and belief, all work required under the contract of the subject construction project has been performed in accordance with the terms thereof, there are no unsatisfied claims for damages resulting from injury or death to any employees, subcontractors, or the public at large arising out of the performance of said contract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.
3. That upon full payment of all sums due him for materials furnished and services rendered by the undersigned in connection with the performance of said contract, as evidence by the amount shown on the Final Application and Certificate for Payment, the Contractor will release the Owner and the Architect and his consultants from any and all claims of any character arising out of or in any way connected with performance of said contract.

ATTEST (IF CORPORATION) _____
NAME OF CONTRACTOR

_____ _____ _____

SECRETARY BY DATE
SUBSCRIBED AND SWORN TO BEFORE ME ON THIS _____ DAY OF _____, 20__ _____.

NOTARY PUBLIC: _____
MY COMMISSION EXPIRES: _____

SUBCONTRACTOR/SUPPLIER AFFIDAVIT AND RELEASE

STATE OF TEXAS **PROJECT: FIRE STATION #42**
OWNER: HAYS CO. ESD #4
COUNTY OF _____ **ARCHITECT: MARTINEZ ARCHITECTS, LP**

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the subcontractor/supplier who supplied, installed, and/or erected the work described below, and that he is duly authorized to make this Subcontractor/Supplier Affidavit and Release:
   Work Performed: _____
   Specification Section(s): _____

That all work is required under the subject subcontract or purchase order of the subject construction project has been performed in accordance with the terms thereof, that all material men, subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of said contract which have not been paid and satisfied in full.

1. That to the best of his knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-contractors, or the public at large arising out of the performance of said contract, or any suits of claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.
2. That he has received full payment of all sus due him for materials furnished and services rendered by the undersigned in connection with the performance of said contract and has and does hereby release the Owner and the Architect and his consultants and the Contractor from any and all claims of any character arising out of or in any way connected with performance of said contract.

ATTEST (IF CORPORATION) _____
NAME OF CONTRACTOR

_____ _____ _____

SECRETARY BY DATE
SUBSCRIBE AND SWORN TO BEFORE ME ON THIS _____ DAY OF _____, 20__ _____.

NOTARY PUBIC: _____
MY COMMISSION EXPIRES: _____

GENERAL CONTRACTOR GUARANTEE

STATE OF TEXAS	**PROJECT:**	**FIRE STATION #42**
	OWNER:	**HAYS CO. ESD #4**
COUNTY OF _____	**ARCHITECT:**	**MARTINEZ ARCHITECTS, LP**

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the contractor who constructed the project referenced above, and that he is duly authorized to make this General Contractor Guarantee.
2. The undersigned Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor's warranty excludes remedy from damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.
3. In the even of failure of materials, products, or workmanship, during the specified warranty periods, the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Owner or Architect.

4. The Contractor warrants the entire project for a period of 12 months from the Date of Substantial Completion and specific sections of work for such additional periods as enumerated in the contract Documents, except as follows:

_____
_____

ATTEST (IF CORPORATION) _____
NAME OF CONTRACTOR

_____ _____ _____

SECRETARY BY DATE
SUBSCRIBE AND SWORN TO BEFORE ME ON THIS _____ DAY OF _____, 20__ _____.

NOTARY PUBIC: _____
MY COMMISSION EXPIRES: _____

SUBCONTRACTOR GUARANTEE

STATE OF TEXAS

COUNTY OF _____

PROJECT: FIRE STATION #42
OWNER: HAYS CO. ESD #4
ARCHITECT: MARTINEZ ARCHITECTS, LP

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the subcontractor who supplied, installed, and/or erected the work described below, and that he is duly authorized to make this Subcontractor Guarantee:

Work Performed: _____

Specification Section(s): _____

1. The undersigned subcontractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms to the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy from damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operations, or normal wear and tear under normal usage.
2. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Contractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner, or Architect.
3. The Subcontractor warrants the work performed for a period of ____ months from the Date of Substantial Completion, except as follows:

_____

_____

ATTEST (IF CORPORATION) _____

NAME OF CONTRACTOR

_____ _____ _____

SECRETARY BY DATE

SUBSCRIBE AND SWORN TO BEFORE ME ON THIS _____ DAY OF _____, 20__ _____.

NOTARY PUBIC: _____

MY COMMISSION EXPIRES: _____

GENERAL CONTRACTOR HAZARDOUS MATERIAL CERTIFICATE

STATE OF TEXAS **PROJECT: FIRE STATION #42**

OWNER: HAYS CO. ESD #4

COUNTY OF _____ **ARCHITECT: MARTINEZ ARCHITECTS, LP**

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the contractor who constructed the project reference above, and that he is duly authorized to make this Certification.
2. That to the best of his information, knowledge, and belief, none of the below-listed hazardous materials have been incorporated into the project:
   - [] Asbestos
   - [] Lead
   - [] P.C.B. (Polychloride Biphenyls)
   - [] Refrigerants R-11, R-12, R-113, R-114, R-500 and R-502

ATTEST (IF CORPORATION) _____
NAME OF CONTRACTOR

_____ _____ _____

SECRETARY BY DATE
SUBSCRIBE AND SWORN TO BEFORE ME ON THIS _____ DAY OF _____, 20__ _____.

NOTARY PUBIC: _____
MY COMMISSION EXPIRES: _____

SUBCONTRACTOR/SUPPLIER HZARDOUS MATERIAL CERTIFICATE

STATE OF TEXAS **PROJECT: FIRE STATION #42**
OWNER: HAYS CO. ESD #4
COUNTY OF _____ **ARCHITECT: MARTINEZ ARCHITECTS, LP**

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, disposes and says:

1. That he is the _____ of _____, the subcontractor/supplier who constructed or provided the sections of work described below, and that he is duly authorized to make this Certification:
   Work Performed:
   _____
   Specification Section(s):
   _____
2. That to the best of his information, knowledge, and belief, none of the below-listed hazardous materials have been incorporated into the project:
   [] Asbestos
   [] Lead
   [] P.D.B. (Polychloride Biphenyls)
   [] Refrigerants R-11, R-12, R-113, R-114, R-500 and R-502

ATTEST (IF CORPORATION) _____
NAME OF CONTRACTOR

_____ _____ _____

SECRETARY BY DATE
SUBSCRIBE AND SWORN TO BEFORE ME ON THIS _____ DAY OF _____, 20__
_____.

NOTARY PUBIC: _____
MY COMMISSION EXPIRES: _____

CONSTRUCTION CONTRACT CLOSE OUT CHECKLIST
PROJECT: _____ ARCHITECT'S PROJECT NO._____

CONTRACTOR_____ DATE _____ CONTRACT DATE _____

THE FOLLOWING IS A CHECKLIST FOR THE USE OF THE ARCHITECT AND CONTRACTOR DURING CONSTRUCTION CLOSE OUT. REFER ALSO TO THE GENERAL CONDITIONS AND THE SUPPLEMENTARY CONDITIONS FOR DETAILED INFORMATION. ALL INFORMATION SHALL BE SUBMITTED IN HARD BOUND COPY (QUANTITY AS SPECIFIED) IN ADDITION TO AN ELECTRONIC FORM. ELECTRON SHALL BE IN PDF FORMAT, FILE NAMES PROPERLY LABELED BY CONTENT AND BOOKMARKED.

A. Substantial Completion Date
   1. Contractor substantially completes Work in accordance with definition of Substantial Completion and submits typewritten detailed list of Items to be completed or corrected. _____
   2. Architect/Consultants observe the construction and, if necessary, prepare supplements to Contractor's List of Items. _____
   3. Contractor completes remedial work as necessary to bring project to point of Substantial Completion as defined. _____
   4. Certificate of Substantial Completion prepared by Architect and executed by all parties. List of any items to be completed or corrected is attached. _____
   5. Contractor returns the following items with the executed Certificate of Substantial Completion:
      Certificate of Occupancy
      Operations and Maintenance Data
      Reports and Certifications
      Record Documents
      Hazardous Material Certifications _____

   Final Completion
   1. Contractor completes all work and submits written notice that all the Work is ready for final inspection and acceptance and submits Final Application for Payment.
   2. Owner/Architect/Consultants observe project for completion. _____
   3. Contractor submits additional final items in binder specified: _____
      2 copies of Contractor's Affidavit of Payment of Debts and Claims (AIA G706)
      2 copies of Contractor's Affidavit of Release of Liens (((AIA G706A)))
      2 copies of Consent of Surety to Final payment (((AIA G707)))
      2 copies of General Contractor Affidavit and Release

2 copies each of separate affidavit and release from each subcontractor/supplier
2 copies of General Contractor Guarantee
2 copies each of separate guarantee from each subcontractor
2 copies each of manufacturer's guarantees
2 copies each of final list of subcontractors/suppliers
2 copies each of Contractor's and Subcontractor's hazardous material certificates
2 copies of other required items
(re: Table of Contents-Project Close Out Manual)

END OF SECTION 01 77 00

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operational manuals for systems, subsystems, and equipment.
   4. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.

B. Related Sections include the following:
   1. Division 01 Section “Project Record Documents” for preparing Record Drawings for operation and maintenance manuals.
   2. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.02 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 4 - Preparation of Operations and Maintenance Documentation for HVAC&R Systems; 2019.

1.04 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return 1 copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 1 copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
   1. Correct or modify each manual to comply with Architect’s comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect’s comments.

1.05 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Table of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, “Preparation of Operating and Maintenance Documentation for Building Systems”.

2.02 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name, address, and telephone number of Contractor.
   6. Name and address of Architect.
   7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the contents of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. Prepare Manual in Adobe Acrobat format linked and bookmarked to section, systems, subsystems, equipment and components. Each item is to be properly identified in a manageable order for use.
   2. For hard copy manuals, if operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystems, equipment, and component. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11 inch (279.4 mm)(115-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or systems.
      b. Identify each binder on front and spine, with printed title “OPERATION AND MAINTENANCE MANUAL,” Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   4. Supplementary Text: Prepare on 8-1/2-by-11 inch (279.4 mm), 20-lb/sq. ft. (75-g/sq. m) white bond paper.

5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.03 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.04 OPERATING MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions.
   2. Performance and design criteria if Contractor is delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.

6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. System and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, identify color-coding where required for identification.

2.05 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identification by product name and arrange to match manual's table of contents. For each product, list name, address and telephone number of Installer or supplier and maintenance service agent, and cross-referenced Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Recording information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
2. Contact data for all equipment and warranty issues – post in view of/on all equipment.

2.06 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturer's Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard printed maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for prevention and routine maintenance and service with standard time allotment.
   1. Schedule Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Tabulate lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent – post in view of/on all equipment.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 EXECUTION

3.01 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble complete set of emergency information indicating procedures for use by emergency personnel and Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.

2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturer's Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

G. Comply with Division 01 Section "Closeout Procedures" for the schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training media.

B. Related Sections including the following:
   1. Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.02 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Including learning objective and outline for each training module.
   1. At completion of training, submit two complete training manuals for Owner's use.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Demonstration and Training Record: Submit two copies at end of each training module.

1.03 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or educating with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Assurance Requirements," experienced in operation and maintenance procedures and training.

1.04 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   1. Motorized doors.
   2. Equipment.

3. Fire-protection systems, including fire alarm, fire pumps, and fire-extinguishing systems.
4. Intrusion detection systems.
5. Heat generation, including boilers, feedwater equipment, pumps, steam distribution piping and water distribution piping.
6. Refrigeration systems, including chillers, cooling towers, condensers, pumps, and distribution piping.
7. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
8. HVAC instrumentation and controls.
9. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies and motor controls.
10. Lighting equipment and controls.
11. Communication systems, including intercommunication, clocks and programming, voice and data equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, including instruction for the following:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Operation manuals.
      c. Maintenance manuals.
      d. Project Record Documents.
      e. Identification systems.
      f. Warranties and bonds.
      g. Maintenance service agreements and similar continuing commitments.
   3. Emergencies: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Instructions on stopping.
      c. Shutdown instructions for each type of emergency.
      d. Operating instructions for conditions outside of normal operating limits.
      e. Sequences for electric or electronic systems.
      f. Special operating instructions and procedures.
   4. Operations: Include the following, as applicable:
      a. Startup procedures.
      b. Equipment or system break-in procedures.
      c. Routine and normal operating instructions.
      d. Regulation and control procedures.
      e. Control sequences.
      f. Safety procedures.
      g. Instructions on stopping.
      h. Normal shutdown instructions.
      i. Operating procedures for emergencies.
      j. Operating procedures for system, subsystem, or equipment failure.

k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instructions on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

B. Set up instructional equipment at instruction location.

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and locations.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, at least seven days' advance notice.

D. Demonstration and Training Media: Record each training module separately. Including classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.03 DEMONSTRATION AND TRAINING VIDEOS

A. General: Record each training module separately. Including classroom instruction and demonstrations, board diagrams, and other visual aids, but not student practice.
   1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital video recordings.

C. Recording: Mount camera on tripod before starting recordings, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

D. Narration: Described scenes on media by audio narration by microphone while digital video is recorded, or by dubbing audio narration off-site after recording. Include description of items being viewed. Described vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION 01 79 00

SECTION 01 91 13
GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning.
   1. Verify that the work is installed in accordance with the Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
   2. Verify and document that functional performance is in accordance with the Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieved this.
   3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
   4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Substantial Completion.

C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

D. The Commissioning Authority is employed by Owner.

E. The Commissioning Authority is employed by Construction Manager on behalf of Owner.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Plumbing Systems:
   1. Domestic gas water heaters.

C. HVAC System, including:
   1. Condensing Units.
   2. Fan Coil Units.
   3. Exhaust Fans.
   4. Split Systems.

D. Electrical Systems:
   1. Lighting controls other than manual switches.

E. Other equipment and systems explicitly identified elsewhere in Contract Documents as required commissioning.

1.03 RELATED REQUIREMENTS

A. Section 01 70 00 - Execution and Closeout Requirements: General startup requirements.

B. Section 01 78 00 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

C. Section 01 79 00 - Demonstration And Training: Scope and procedures for Owner personnel training.

D. Section 23 08 00 - Commissioning of HVAC: HVAC control system testing; other requirements.

1.04 REFERENCE STANDARDS

A. ANSI/RESNET/ICC 301 - Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units Using an Energy Rating Index; 2022.

B. ANSI/RESNET/ICC 380 - Standard for Testing Airtightness of Building, Dwelling Unit, and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems; and Airflow of Mechanical Ventilation Systems; 2022.

C. ASHRAE Std 202 - The Commissioning Process Requirements for New Buildings and New Systems; 2024.

D. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings; 2025a.

E. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2019.

F. ASTM E1827 - Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door; 2022.

G. CSI/CSC MF - Masterformat; 2016.

H. NEBB S110 - Whole Building Technical Commissioning of New Construction; 2019, with Errata (2022).

I. PECI (Samples) - Sample Forms for Prefunctional Checklists and Functional Performance Tests; Current Edition.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architects; in that case, submit to Architect first.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as “Draft” are intended for the use of the Commissioning Authority in preparation of Prefuntional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
   5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.

B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
   1. Manufacturer’s product data, cut sheets, and shop drawings.
   2. Manufacturer’s installation instructions.
   3. Startup, operating, and troubleshooting procedures.
   4. Fan and pump curves.
   5. Factory test reports.
   6. Warranty information, including details of Owner’s responsibilities in regard to keeping warranties in force.

C. Manufacturers’ Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

F. Commissioning Issues Log:
   1. Construction observations.
   2. Supporting photographs.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
   1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F (0.3 degree C)and resolution of plus/minus 0.1 degree F (0.05 degree C).
   2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
   3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specified 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 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.
   1. Commissioning will be phased (by floors, for example) to minimize the total construction time.

D. Commissioning Schedule:
   1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
   2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
   3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 DOCUMENTATION IDENTIFICATION SYSTEM

A. Give each submitted form or report a unique identification; use the following scheme.

B. Type of Document: Use the following prefixes:
   1. Startup Plan: SP-.
   2. Startup Report: SR-.
   3. Prefunctional Checklist: PC-.
   4. Functional Test Procedure: FTP-.
   5. Functional Test Report: FTR-.

C. System Type: Use the first 4 digits from CSI/CSC MF (Master Format), that are applicable to the system; for example:
   1. 2300: HVAC system as a whole.
   2. 2320: HVAC Piping and Pumps.
   3. 2330: HVAC Air Distribution

D. Component Number: Assign numbers sequentially, using 1, 2, or 3 digits as required to accommodate the number of units in the system.

E. Test, Revision, or Submittal Number: Number each successive iteration sequentially, starting with 1.

F. Example: PC-2320-001.2 would be the Prefunctional Checklist for equipment item 1 inch (25.4 mm) the HVAC piping system, probably a pump; this is the second, revised submittal of this checklist.

3.03 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to the stamp.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.04 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
   1. No sampling of identical or near-identical items is allowed.
   2. These checklists do not replace manufacturer's recommended startup checklists, regardless of apparent redundancy.
   3. Prefunctional Checklists forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
      a. Certification by installing contractor that the unit is properly installed, started up, operating and ready for Functional Testing.
      b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
      c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed".
      d. Serial number installed unit.
      e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.
      f. Sensor and actuator calibration information.
   4. All preliminary Prefunctional Checklists are included in the contract documents; the Commissioning Authority has the authority to modify these and will furnish final versions as applicable.
   5. A preliminary list of Prefunctional Checklists is attached, to indicate anticipated scope.
   6. PECI (Samples) found at http://www.peci.org/library/mcpgs.htm indicate anticipated level of detail for Prefunctional Checklists.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
   1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all lines are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
4. If any Checklist line item is not relevant, record reasons on form.
5. Contractor may independently perform startup inspections and/or tests, at Contractor's opinion.
6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Authority within two days of completion.
8. See Section 01 70 00 - Execution and Closeout Requirements 01 70 00 – Execution and Closeout Requirements for additional general startup requirements.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in the Contract Documents.
2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in the Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiencies to the Commissioning Authority immediately.

3.05 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklists and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.
1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents or does not perform properly.
2. Use the standard form provided with copies submitted to Owner and Contractor.
3. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.

4. Identical or Near-identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
6. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:
1. Some test procedures are included in the Contract Documents; where Functional Test procedures are not included in the Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
2. Examples of Functional Testing:
   a. Test the dynamic function and operation of equipment and systems (rater than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
   b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperature, fire alarm, power failure, etc.
   c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
   d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.
3. Some preliminary Functional Test procedures are included in the contract documents; the Commissioning Authority has the authority to modify these and will furnish final versions as applicable.
4. A preliminary list of Functional Tests is attached, to indicate anticipated scope.
5. PECI (Samples)found at http://www.peci.org/library/mcpgs.htm indicated anticipated level of detail for Functional Tests.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

G. Factory Tests: Commissioning Authority and Contractor are responsible for coordinating testing of equipment at the factory by factory personnel, to ensure compliance with commissioning requirements.

H. Field Test By Others: Where Functional Tests ae indicated as to be performed by others not subject to the Contract Documents, those tests are not subject to these commissioning requirements.

3.06 SENSOR AND ACTUATOR CALIBATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibration.

B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:
   1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
   2. Verify that sensors with shielded cable are grounded only at one end.
   3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F (0.1 degree C)of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
   4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters – Standard Application:
   1. Make a reading with a calibrated test instrument within 6 inches (152.4 mm) of the site sensor.
   2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
   3. If not, install offset, or calibrate or replace sensor.

E. Sensors With Transmitters – Standard Application
   1. Disconnect sensor.
   2. Connect a signal generator in place of sensor.
   3. Connect ammeter in series between transmitter and building automation system control panel.
   4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
   5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
   6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
   7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
   8. Reconnect sensor.
   9. Make a reading with a calibrated test instrument within 6 inches (152.4 mm) of the site sensor.
   10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
   11. If not, replace sensor and repeat.
   12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
   1. Watthour, Voltage, Amperage: 1 percent of design.
   2. Pressure, Air, Water, Gas: 3 percent of design.
   3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees Fahrenheit (-17.56 degrees Celsius).
   4. Relative Humidity: 4 percent of design.
   5. Barometric Pressure: 0.1 inch (2.54 mm) of Hg (340 Pa).
   6. Flow Rate, Air: 10 percent of design.
   7. Flow Rate, Water: 4 percent of design.
   8. Flow Rate, Steam: 3 percent of design.
   9. AHU Wet Bulb and Dew Point: 2 degrees Fahrenheit (-16.67 degrees Celsius).
   10. Hot Water Coil and Boiler Water Temperature: 1.5 degrees Fahrenheit (-16.94 degrees Celsius).

11. Cooling Coil, Chilled and Condenser Water Temperature: 0.4 degrees Fahrenheit (-17.56 degrees Celsius).
12. Combustion Flue Temperature: 5 degrees Fahrenheit (-15 degrees Celsius).
13. Oxygen and CO2 Monitors: 0.1 percentage points.
14. CO Monitor: 0.01 percentage points.
15. Natural Gas and Oil Flow Rate: 1 percent of design.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such method on an attached sheet.

H. 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 to 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).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
2. Use an ultra-sonic flow meter to detect flow or leakage.

3.07 TEST PROCEDURES – GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional 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.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test conditions.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
1. Identical Units: Define as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
   a. Major equipment.
   b. Life-safety-critical equipment.
   c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the “first sample”.
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop testing and require Contractor to perform and document a checkout of the remaining units to continue testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees Fahrenheit (10 degrees Celsius) to 75 degrees Fahrenheit (23.89 degrees Celsius) to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.
   1. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
   2. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authorities request, Contractor shall trend up to 20 percent more points then specified at no extra charge.
   3. Other points will be monitored by the Commissioning Authority using dataloggers.
   4. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
   5. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
   6. Graphical output is desirable and is required for all output if the system can produce it.
   7. Monitoring may be used to augment manual testing.

3.08 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 - Closeout Submittals 01 78 00 – Closeout Submittals 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.

END OF SECTION 01 91 13

SECTION 02 41 13.10
REMOVING EXISTING PAVEMENT AND STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removing concrete paving, asphaltic concrete pavement, and base courses.

B. Removing concrete curbs, concrete curbs and gutters, sidewalks, and driveways.

C. Removing pipe culverts, sewers and water lines.

D. Removing existing inlets and manholes.

E. Removing miscellaneous structures of concrete or masonry.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Payment for removing and disposing of asphaltic surfacing and unreinforced base under asphaltic surfacing, regardless of the thickness of base encountered, is on a square yard basis measured between lips of gutters or edge of pavement.
2. Payment for removing and disposing of existing base material with no permanent surface, regardless of the thickness encountered, is on a square yard basis.
3. Payment for removing and disposing of reinforced concrete pavement, regardless of its thickness, is on a square yard basis measured from back-to-back of curbs or edge of pavement if curbs are not present. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.
4. Payment for removing and disposing of monolithic curbs and gutters, and concrete curbs, is on a linear foot basis measured along the face of the curb.
5. Payment for removing and disposing of cement stabilized shell base course, with or without asphaltic surfacing, is on a square yard basis.
6. Payment for removing and disposing of concrete sidewalks is on a square foot basis.
7. Payment for removing and disposing of concrete driveways is on a square yard basis.
8. Payment for removing and disposing of miscellaneous concrete and masonry structures is on a cubic yard basis of the structure in place.
9. Payment for removing and disposing of pipe culverts, sewers and water lines is on a linear foot basis for each diameter and each material type of pipe removed. Cost and work shall include the removal and disposal of existing cement stabilized bedding if present.
    a. Payment for removing and disposing of existing inlets is on a unit price basis for each inlet removed. Cost and work shall include the removal and disposal of existing cement stabilized bedding if present.
    b. Payment for removing and disposing of existing manholes is on a unit price basis for each manhole removed. Cost and work shall include the removal and disposal of existing cement stabilized bedding if present.
    c. Payment for saw cutting of existing pavement is on a linear foot basis.
    d. No pavement will be made for work removed with out the Engineer’s approval or for pavements or structures removed for the Contractor’s convenience.

B. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

C. Include cost of installing suitable backfill material and proper compaction (95% of the Std. Proctor Density) in cost of each item to be removed. No separate pay for this item.

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate removal work with utility companies.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

A. Obtain advance approval from Engineer for dimensions and limits of removal work.

B. Identify known utilities below grade. Stake and flag locations.

3.02 PROTECTION

A. Protect the following from damage or displacement:
   1. Adjacent public and private property.
   2. Trees, plants, and other landscape features designated to remain.
   3. Utilities designated to remain.
   4. Pavement and utility structures designated to remain.
   5. Bench marks, monuments, and existing structures designated to remain.

3.03 REMOVALS

A. Remove pavements and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.

B. Minimize amount of earth loaded during removal operations.

C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of two (2) inches.

D. Where street and driveway saw cut locations coincide or fall within three (3) feet of existing construction or expansion joints, break out to existing joint.

E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint. Where existing end of pipe culvert or end of sewer is to remain, install an 8-inch thick masonry plug in pipe end prior to backfill.

F. When removing existing utilities or structures, all existing backfill material (i.e. cement stabilized sand) shall also be removed. Include in price of utility or structure removed.

3.04 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Division 31.

B. Trench and structure excavations shall be backfilled in 8” lifts and compacted to 95% of the Std. Proctor Density. Reference Geotechnical Report and Plans for details on acceptable backfill.

3.05 DISPOSAL

A. Inlet frames, grates, plates, and manhole frames and covers may remain property of the Owner. Disposal shall be in accordance with requirements of Division 1.

B. Remove from the site debris resulting from work under this section in accordance with requirements of Division 1.

END OF SECTION 02 41 13.10

SECTION 03 10 00
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Form-facing materials for cast-in-place concrete.
   2. Form liners.
   3. Shoring, bracing, and anchoring.

B. Related Requirements:
   1. Section 32 13 13 “Concrete Paving” for formwork related to concrete pavement and walks.

1.03 DEFINITIONS

A. Form-facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold pr sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.04 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022, with Errata (2025).

B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026a.

C. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

1.05 ACTION SUBMITTALS

A. Product Data: For each of the following:
   1. Exposed surface form-facing material.
   2. Exposed for cylindrical columns.
   3. Pan-type forms.
   4. Void forms.
   5. Form liners.
   6. Insulating concrete forms.
   7. Form ties.
   8. Waterstops.
   9. Form-release agent.

1.06 INFORMATION SUBMITTALS

A. Qualification Data: For testing and inspection agency.

1.07 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.08 HANDLING

A. Form-liners: Store form liners under cover to protect from sunlight.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
   1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
   2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
      a. For architectural concrete specified in Section 03 33 00 "Architectural Concrete" limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
   1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:
      a. Wind Loads: As indicated on Drawings.
         1) Horizontal Deflection limit: Not more than 1/24 of the wall height.

2.02 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:
   1. Provide continuous, true, and smooth concrete surfaces.
   2. Furnish in largest practicable sizes to minimize number of joints.
   3. Acceptable Materials: As required to comply with Surface Finish designation specified in Section 03 33 00 "Cast-In-Place Concrete", and as follows:
      a. Plywood, metal, or other approved panel materials.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
   1. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces without spiral or vertical seams not exceeding specified formwork surface class.
   1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation, with straight or tapped end forms.

2.03 WATERSTOPS

A. Flexible Rubber Waterstops: U.S. Army Corps of Engineers CRD-C 513, with factory installed metal eyelets for embedding in concrete to prevent passage of fluids through joints, with factory fabricated corners, intersections, and directional changes.
   1. Profile: Ribbed with center bulb.
   2. Dimensions: 4 inches (101.6 mm) by 3/16 inch (4.76 mm) thick (3.94 inch (100 mm) by 0.19 inch (4.8 mm) thick) nontapered.

B. Chemically Resistant Flexible Waterstops: Thermoplastic elastomer rubber waterstops with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through

joints; resistant to oils, solvents, and chemicals, with factory fabricate corners, intersections, and directional changes.
1. Profile: Ribbed with center bulb.
2. Dimensions: 4 inches (101.6 mm) by 3/16 inch (4.76 mm) thick (3.94 inch (100 mm) by 0.19 inch (4.8 mm) thick) nontapered.

C. Flexible PVC Waterstops: U.S. Army Corps of Engineers CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints, with factory fabricate corners, intersections, and directional changes.
1. Profile: Ribbed with center bulb.
2. Dimensions: 4 inches (101.6 mm) by 3/16 inch (4.76 mm) thick (3.94 inch (100 mm) by 0.19 inch (4.8 mm) thick) nontapered.

D. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

E. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch (10 by 19 mm).

2.04 RELATED MATERIALS

A. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

B. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.86 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

F. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that leave no corrodible metal closer than 1 inch (25.4 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch (25.4 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 EXECUTION

3.01 INSTALLATION OF FORMWORK

A. Comply with ACI 301 (ACI 301M).

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M) and to comply with the Surface Finish designations specified in Section 03 30 00 “Cast-In-Place Concrete” for as-cast finishes.

C. Limit concrete surface irregularities as follows:
1. Surface Finish-1.0: ACI 117 Class D, 1 inch (25.4 mm).
2. Surface Finish-2.0: ACI Class B, 1/4 inch (6.35 mm).

3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch (3.18 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.
   1. Minimize joints.
   2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
   1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
   2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
   1. Provide and secure units to support screed strips.
   2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
   1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
   2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete as indicated per drawings.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches (304.8 mm).

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
   1. Determine sizes and locations from trades providing such items.
   2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:
   1. Construct joints true to line with faces perpendicular to surface plane of concrete.
   2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   3. Place joints perpendicular to main reinforcement.
   4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
      a. Offset joints in girders a minimum distance of twice the beams width from a beam-girder intersection.
   5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   6. Space vertical joints in walls as indicated on Drawings.
      a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
   1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
   2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
   1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
   3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at inlets, shelf angles, and other conditions.
   4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
   5. Clean embedded items immediately prior to concrete placement.

3.03 INSTALLATION OF WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm.
   1. Install in longest lengths practicable.
   2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
   3. Allow clearance between waterstop and reinforcing steel of not less than 2 times the largest concrete aggregate size specified in Section 03 30 00 "Cast-In-Place Concrete".
   4. Secure waterstops in correct position at 12 inches (304.8 mm) on center.
   5. Field fabricate joints in accordance with manufacturer's instructions using heat welding.
      a. Miter corners, intersections, and directional changes in waterstops.
      b. Align center bulbs.
   6. Clean waterstops immediately prior to placement of concrete.
   7. Support and protect exposed during progress of the Work.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding mechanically fastening, and firmly pressing into place.
   1. Install in longest lengths practicable.
   2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
   3. Protect exposed waterstops during progress of the Work.

3.04 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 degrees Fahrenheit (10 degrees Celsius) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength unless noted otherwise on the drawings.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work.
   1. Split, frayed, delaminating, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
   2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
   1. Align and secure joints to avoid offsets.
   2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.05 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slabs tolerances is incomplete.

3.06 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspection agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspection agency to perform tests and inspections and to submit reports.

C. Inspections:
   1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 03 10 00

SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.

B. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2026.

C. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2026a.

D. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

E. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 SUMMARY

A. Section Includes:
   1. Steel reinforced bars.
   2. Welded-wire reinforcement.

B. Related Requirements:
   1. Section 32 13 13 “Concrete Paving” for reinforcing related to concrete pavement and walks.

1.04 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Each type of steel reinforcement.
   2. Epoxy repair coating.
   3. Zinc repair material.
   4. Bar supports.
   5. Mechanical splice couplers.

B. Shop Drawings: Comply with ACI SP-066:
   1. Include placing drawings that detail fabrication, bending, and placement.
   2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
   3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
   1. Location of construction joints is subject to approval of the Architect and EOR.

D. Contraction Joint Layout: Indicate proposed contraction joint required to build the structure:
   1. Location of contraction joints is subject to approval of Architect and EOR.

E. Delegated-design Submittal: For structural thermal break insulated connection system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Welding certificates:
   1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification".
   2. Dual-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification".

C. Material Test Reports: For the following, form a qualified testing agency:
   1. Steel Reinforcement:
      a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
   2. Mechanical splice couplers.

D. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D1.4M.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
   1. Store reinforcement to avoid contact with earth.
   2. Do not allow epoxy-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
   3. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
   4. Do not allow stainless steel reinforcement to come into contact with uncoated reinforcement.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy Steel Reinforced Bars: ASTM A706/A706M, deformed.

C. Headed-Steel Reinforced Bars: ASTM A970/A970M.

2.03 REINFORCED ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolster, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
   1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CSRI Class 2 stainless steel bar supports.
      a. For concrete surfaces exposed to view, where legs of wire bar supports contract forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

2.04 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice".

PART 3 EXECUTION

3.01 PREPARATION

A. Protection of In-Place conditions:
   1. Do not cut or puncture vapor retarder.
   2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.02 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.
   1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
   2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch (25.4 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.
   1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches (609.6 mm), whichever is greater.
   2. Stagger splices in concordance with ACI 318 (ACI 318M).
   3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
   4. Weld reinforcing bars in accordance with AWS D1.4/D1.4M, where indicated on Drawings.

G. Install welded-wire reinforcing in longest practicable lengths.
   1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice".
      a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches (304.8 mm).
   2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50.8 mm) for plain wire and 8 inches (203.2 mm) for deformed wire.
   3. Offset laps of joining sheet widths to prevent continuous laps either direction.
   4. Lace overlaps with wire.

3.03 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement.
   2. Continue reinforcement across construction joints unless otherwise indicated.
   3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.04 INSTALLATION TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.05 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified testing and inspection agency to perform field tests and inspections and to submit reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections;
   1. Steel-reinforcement placement.
   2. Steel-reinforcement welding.

END OF SECTION 03 20 00

SECTION 03 30 00
IN-PLACE CONCRETE

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

B. ASTM A576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality; 2025.

C. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.

D. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2025.

E. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.

F. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2025.

G. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.

H. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018 (Reapproved 2023).

I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

J. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

K. ASTM E1155/E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2023.

L. 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; 2024.

M. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.03 DESCRIPTION OF WORK

A. Extent of concrete work is shown on drawings, including schedules, notes and details which show size and location of members and type of concrete to be poured. Furnish all labor, materials, services, equipment and hardware required in conjunction with or related to the forming, delivery and pouring of all poured-in-place concrete work.

B. Concrete paving and walks are specified in Division 32.

C. Architectural Concrete, Precast Concrete, Post-Tensioned Concrete and special requirements for Tilt-up Concrete Construction are specified in other Division-3 sections.

1.04 QUALIFICATIONS

A. The concrete supplier shall have a minimum of two years experience in manufacturing ready-mix concrete products complying with ASTM C 94 requirements for production facilities and equipment. The supplier must be certified according to the National Ready Mixed Concrete Association’s Certification of Ready Mixed Concrete Production Facilities.

B. The concrete contractor shall have a minimum of two years experience with installation of concrete similar in material, design and extent to that indicated for this Project and whose work has resulted in construction with a record of successful -service performance.

C. Any testing laboratory retained to run certain tests required by this specification shall meet the basic requirements of ASTM E329.

1.05 QUALITY CONTROL

A. The contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

B. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
   1. ACI 301 – “Specifications for Structural Concrete for Buildings”.
   2. ACI 117 – “Specifications for Tolerances for Concrete Construction and Materials”.
   3. ACI 318 – “Building Code Requirements for Reinforced Concrete”.

1.06 CONCRETE REINFORCED STEEL INSTITUTE (CRSI), “MANUAL OF STANDARD PRACTICE”.

A. Document Conflict and Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.

B. Inspection and Testing of the Work: Materials and installed work may require testing and retesting, as directed by the governing building code or the Architect/Engineer, at any time during progress of work. The Contractor shall provide adequate notification to the Owner’s Testing Agency of construction operations including the project schedule to allow the Testing Agency to schedule inspections. The Contractor shall make adequate arrangement with the Owner’s Testing Agency for inspection of material stockpiles and facilities. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents. Tests not specifically indicated to be done at the Owner’s expense, including retesting of rejected materials and installed work, shall be done at the Contractor’s expense. See Testing Laboratory section of the Specifications.

C. Acceptance Criteria for Concrete Strength: The strength level of an individual class of concrete shall be considerate and satisfactory if both the following requirements are met:
   1. The average of all sets of three consecutive strength tests equal or exceed the required f’c.
   2. No individual strength test falls below the required f’c by more than 500 psi (3447.38 kPa).
   3. A strength test shall be defined as the average strength of two 6” x 12” cylinder breaks or three 4” x 8” cylinder breaks tested at the strength age indicated on the drawings for that class of concrete.

D. Responsibility for Selection and Use of Concrete Admixtures and Chemical Treatments: The Contractor shall be responsible for selecting admixtures and surface treatments that are compatible with the intended use of the concrete including all final surface treatments called for within this or other Specifications or on the structural or architectural drawings. The Contractor is responsible for following the manufacturer’s instructions for the use of their product including abiding by any limitations placed by the manufacturer on the use of any of its products.

E. Responsibility for Design of Formwork: The General Contractor is responsible for the design, construction, and safety of all formwork. The General Contractor shall employ a professional engineer who is licensed in the state where the project is located and is experienced in the design of formwork to design all formwork and formwork removal. Forms shall be designed to withstand all loads imposed while in place including wet weight of concrete, construction equipment, live loads, and lateral loads due to wind and wet concrete imbalance. The General Contractor is responsible for determining when forms and other temporary supports may be removed.

F. Survey for Anchor Rods: The Contractor shall use a qualified land surveyor to lay out the proper location of all embedded anchor rods for columns above before they are encased in concrete. The surveyed locations of such elements shall be submitted to the Architect/Engineer for record.

1.07 PREINSTALLATION CONFERENCES

A. Pre-Concrete Conference:
   1. At least 7 days prior to beginning concrete work, the Contractor shall conduct a meeting to review the proposed mix designs and to discuss required methods and procedures to produce concrete construction of the required quality. Also review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for materials inspection, testing and certifications. The Contractor shall send a pre-concrete conference agenda to all attendees 7 days prior to the scheduled date of the conference.
   2. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following: Contractor's Superintendent Laboratory responsible for the concrete design mix Laboratory responsible for field quality control Concrete Subcontractor Ready-Mix Concrete Producer Owner's and Architect's/Engineer's Representative.
   3. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall be transmitted to the following fi information purposes: Owner's Representative Architect/Engineer-of-Record.
   4. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least 7 days prior to the scheduled date of the conference.

1.08 SUBMITTALS

A. Shop Drawings: Submit shop drawings for all reinforcing steel and related accessories for the Engineer's approval. Shop drawings shall show arrangement and layout, bending and assembly diagrams, bar schedules, stirrup spacing, splicing and laps of bars and shall be prepared in accordance with CRSI Standards. Submit details for steel templates that are to be used when placing dowels for columns, plinths, or pilasters out of foundation elements or for placing anchor rods structural steel members.

B. Product Data: submit manufacturer's product data with application and installation instructions for proprietary materials and items, including admixtures, patching compounds, epoxies, grouts, waterstops, joint systems, curing compounds, dry-shake finish materials, hardeners, sealers, mechanical splices, hooked anchorage systems, dowel bar substitute systems, dowel bar sleeves, and others as requested by Architect/Engineer.

C. Samples: Submit samples of materials specified if requested by Architect/Engineer, including names, sources and descriptions.

D. Mix Designs: submit mix designs as specified herein.

E. Material and Mill Certificates: Provide material and mill certificates as specified herein and in the Testing Laboratory section of the Specifications. The Manufacturer and Contractor shall sign the material and mill certificates certifying that each material item complies with specified requirements. Provide certification from admixture manufacturers that chloride ion content complies with specified requirements.

F. Formwork Drawings: Formwork drawings, prepared under the supervision and sealed by a registered professional engineer in the state where the project is located, shall be submitted for Owners record and shall be reviewed by the Engineer for conformance to structural layout only. The professional engineer shall submit calculations for record purposes only for all concrete formwork. Such shop drawings shall indicate types of materials, sizes, lengths, connection details, design allowance for construction loads, anchors, form ties, braces, construction joints, reveals, camber, openings, formwork coatings and all other pertinent information.

G. International Conference of Building Official (ICBO) Technical Reports: Submit technical reports of approval from ICBO for mechanical splice hooked anchorage systems, and dowel bar substitute systems.

H. Construction Joints: Submit drawing of proposed construction joint locations in concrete for slab on grade, mat foundations, and walls. Submit any additional or changed reinforcing that is required at construction joints that differs from that shown on the drawings.

I. Minutes of preconstruction conference.

J. Surveys: Submit reports certifying that all anchor rods for columns above are in their proper location prior to placing of concrete.

1.09 PROVISION FOR OTHER WORK

A. Provide for installation of insert, hangers, metal ties, anchors, bolts, angle guards, dowels, thimbles, slots, nailing strips, blocking, grounds and other fastening devices required for attachment of work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves in any concrete slabs except where shown on the drawings or upon written approval of the Architect/Engineer.

B. Protect adjacent finish materials against damage and spatter during concrete placement.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type III, or ASTM C 1157, Type GU or HE unless otherwise approved by the Architect/Engineer.
   1. Use one brand of cement, for each class of concrete, throughout the project, unless approved otherwise by the Architect/Engineer and the Owner's Testing Laboratory. Submit mill certificates certifying conformance to this specification for each brand and type of cement.

B. Testing of cement in lieu of mill certificate submittal will be required if:
   a. The cement has been in storage at the mixing site for over 30 days.
   b. It is suspected by the Owner, Architect, Engineer or Owner's Testing Laboratory that the cement has been damaged in storage or in transit or is in any way defective.

C. Low-alkali cement: Cement that has the additional requirement that equivalent alkalis (Na2O + 0.658K20) do not exceed 0.60% according to ASTM C 150-00, Table 2.

D. Fly Ash: ASTM C618, Class C or F.

E. Normal Weight Aggregates: ASTM C 33 and as herein specified. Submit material certificates from aggregate supplier or test results from an independent testing agency certifying conformance to this specification for each source of aggregate.
   1. If required by the provisions of this specification in this section entitled "Proportioning and Design of Concrete Mixes", submit certification that aggregate does not contain any deleterious materials that react with alkalis in the concrete mix to cause excessive expansion of the concrete for concrete that is exposed to wetting, has extended exposure to humid atmosphere, or is in contact with moist ground. This includes the following locations in this project:

F. Water: Comply with the requirements of ASTM C 1602.

G. Air-Entraining Admixture: ASTM C 260. Provide air entraining as specified in Table 4.2.2.4 of ACI 301-05 inch (127 mm) all concrete exposed to freezing and thawing. Interior steel troweled surfaces subjected to vehicular traffic shall not have more than 3% entraining air. Surfaces scheduled to receive hardeners shall not have more than 3% entrained air.
   1. Subject to compliance with requirements, provide one of the following products and manufacturers:
      a. "Darex-" or "Daravair" series; W.R. Grace & Co.
      b. "MBAE90" or "Micro-Air"; BASF Admixtures, Inc.

c. “Sika AER”; Sika Corporation.
d. “Air Mix” or “AEA-92”; The Euclid Chemical Company, Inc.
e. “Eucon Air 30” or “Eucon Air 40”; The Euclid Chemical Co., Inc.

2. Submit manufacturer’s certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

H. Water-Reducing Admixture: ASTM C 494, Type A. See maximum permissible chloride ion content in concrete specified below:
1. Subject to compliance with requirements, provide one of the following products and manufacturers:
a. “Pozzolith 322N” or “Polyheed 997”; BASF Admixtures, Inc.
b. “Plastocrete 16”; Sika Chemical Corp.
c. “Eucon WR-75 or WR-91”; the Euclid Chemical company.
d. “WRDA” series; W.R. Grace & Co.
e. “Eucon NW” or “Eucon LW”; The Euclid Chemical Co., Inc.
2. Submit manufacturer’s certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

I. Mid-Range Water-Reducing Admixtures: ASTM C 494, Type A and Type F. See maximum permissible chloride ion content in concrete specified below:
1. Subject to compliance with requirements, provide one of the following products and manufacture:
a. “Polyheed 997”; BASF Admixtures, Inc.
b. “Eucon MR”; The Euclid Chemical Company, Inc.
c. “Sikament HP”; Sika Chemical Corp.
d. “Daracem” or “Mira” series; W.R. Grace & Co.
e. “Eucon X15” or Eucon X20”; The Euclid Chemical Co., Inc.
2. Submit manufacturer’s certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

J. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G. See maximum permissible chloride ion content in concrete specified below:
1. Subject to compliance with requirements, provide one of the following products and manufacturers:
a. “ADVA” or “Daracem”; W.R. Grace & Co.
b. “Rheobuild 1000” or “Glenium 30/30”; BASF Admixtures, Inc.
c. “Sikament”; Sika Chemical Corp.
d. “Eucon 37/1037” or “Plastol” series; the Euclid Chemical Company, Inc.; “Eucon SP” or “Eucon RD”, The Euclid Chemical Co., Inc.
2. Submit manufacturer’s certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

K. Corrosion Inhibitor: Amine-Ester type Products:
1. Subject to compliance with requirements, provide the following at dosage rates per manufacturer’s recommendation:
a. “Rheocrete 222+”; BASF Admixtures, Inc.

L. Calcium Chloride and Chloride Ion Content:
1. Calcium chloride or admixtures containing more than 0.5% chloride ions by weight of the admixtures are not permitted.
2. The maximum water-soluble chloride ion concentration in hardened concrete aged from 28 to 42 days contributed from all ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the limits specified in ACI 301-05 Table 4.2.2.6. Water-soluble chloride ion tests shall conform to ASTM C 1218. One test shall be run for each class of concrete before the mix design submittal and each time a change is made to the mix design (such as change in aggregate type or source).

3. The Concrete Supplier shall certify on the Mix Design Submittal Form that the chloride ion content in all concrete mix designs used on the project will not exceed limits stated above.

M. Certification: Written conformance to all of the above mentioned requirements and the chloride ion content of the admixture as tested by an accredited laboratory will be required from the admixture manufacturer at the time of mix design review by the Engineer.

2.02 REINFORCEMENT MATERIALS

A. Reinforcement:
1. Reinforce materials shall be delivered from the mil in bundles that are identified as to heat number and manufacturer and accompanied with mill and analysis test reports and an affidavit from the supplier stating that the material conforms with the requirements of the governing ASTM specification listed herein.
2. Deformed bar material that is not identifiable according to the criteria listed above shall be tested for tensile strength and bend tests according to ASTM A 615 on a sample of 2 bars for each ten tons or fraction thereof of unidentified material for each bar size. The bars shall be a minimum of 24 inches (609.6 mm) long. Bend tests are not required for #14 and #18 bars. Submit the results of such tests for record.
3. Reinforcing Steel: Reinforcing steel shall conform to ASTM A 615 Grade 60 as noted on the Drawings.
4. Weldable Reinforcing Steel: All reinforcing steel required to be welded shall conform to ASTM A 706.
5. Deformed Bar Anchors: Deformed Bar Anchors shall conform to ASTM A 496 with a minimum yield strength of 75,000 PSI. Standard ASTM A 615 Grade 60 or Grade 40 reinforcement bars may not be substituted for deformed bar anchors.
6. Plain Steel Welded Wire Fabric: Not Permitted.
7. Joint Dowel Bars: Smooth bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 615, Grade 40 or A36, plain-steel bars. Cut bars true to length with ends square and free of burrs.
8. Dowel Bar Sleeves: Plastic or gage meal (26 ga. Min.) sleeves with an inside diameter of 1/16 inch (1.59 mm) greater than the dowel bar that it encases, that have the strength, durability, and design to provide free movement of the dowel relative to the concrete slab and that are specifically manufactured for this purpose.
9. Alternate Slab-on-Grade Joint Load Transfer Systems: A system that consists of flat, ASTM A 36 plate that is saw cut into a square or rectangular shape and is embedded into or encased by a plastic sleeve that allows movement in both lateral directions but not in the vertical direction. Acceptable systems are manufactured by PNA Construction Technologies with products known by the names “Diamond dowel System” and “PD3 Basket” and Greenstreak Group Inc. with products known as “Speed Plate” and “Double-tapered Basket”.
10. Tie Wire: Tie wire shall be annealed steel tie wire, minimum 16 gauge. Provide only plastic coated or stainless tie wire in exposed concrete structures and all architectural concrete.

B. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and in place. Use wire bar type or all plastic supports complying with CRSI recommendations:
1. Slabs-on-Grade: Use precast concrete bar supports (dobies) or supports with sand plates or horizontal runners designed for use on ground.
2. Spread Footing Bottom Reinforcement: Use precast concrete bar supports (dobies) or chairs designed for soil-supported slabs.

2.03 SPLICES

A. Mechanical Tension Splices: Mechanical splices shall conform to Type 1 splices in accordance with ACI 318-05, ch. 21 as expressed in an ICC-Evaluation Service Evaluation Report. The bar ends that are to attach to the splice shall be prepared and installed in accordance with the manufacturer’s requirements. Splices shall be approved by the ICC-Evaluation Service, Inc and

shall have the Evaluation Report submitted for Engineer review. The following are acceptable mechanical tension splices (splices qualified for use with grade 75 bars are parenthetically noted):

1. “Barlock, S-Series”; Dayton/Richmond.
2. “US/MC-SAE Mechanical Coupler”; Dayton/Richmond, Inc.
3. “DB Grout Sleeve”; Dayton/Richmond.
4. “ZAP Screwlok”; BarSplice Products, Inc. (qualified for use with grade 75 bars).
5. “BPI Grip XL System”; BarSplice Products, Inc.
6. “Taper Threaded Grip Twist System”; BarSplice Products, Inc.
7. “Lenton Coupler”; Erico Products, Inc. (for grade 75 bars, use only “Standard Coupler”).
8. “NMB splice Sleeve”; Splice Sleeve North America” (qualified for grade 75 #7 bars and higher).
9. “Barlock, L-Series”; Dayton Superior.

B. “Taperlock Couplers”; Dayton Superior.
   1. “Lenton Intrlok”; Erico Products, Inc.
   2. “Griptec”; Dextra Manufacturing Co.,
   3. Or other Engineer-approved product.

C. Splice Type and Lap Lengths: Required splice type and lap lengths are defined on the drawings. Lap splice lengths for unscheduled bars not shown otherwise on the drawings shall be 30 bar diameters minimum.

D. Dowel Bar Replacement: All grade 60 reinforcing steel dowel bars shown on the drawings crossing concrete construction joint surfaces with inserts cast flush against the form and having reinforcing bars connected to the insert in a subsequent concrete pour shall conform to the following:
   1. Splice connection at insert shall develop the full tensile strength of the reinforcing steel conforming to a Type 2 splice in accordance with ACI 318-05, ch. 21.
   2. Splices shall be approved by the ICC Evaluation Service, Inc. and shall have an Evaluation Report submitted for Engineer review.
   3. The following are acceptable products (for use only with grade 60 bars):
      a. “Lenton Form Saver”, Erico Products, Inc.
      b. “DB-SAE Dowel Bar Splicer”, Dayton/Richmond, Inc.
      c. Or other Engineer-approved product.

E. Hooked Anchorage Replacement: Reinforcing bar terminations shall be manufactured out of ASTM A576 material and shall develop the full tensile strength of the bar when installed at the manufacturer’s recommended depth. The Anchorage shall be approved by the ICC Evaluation Service and shall have an Evaluation Report submitted for Engineer review. The following are acceptable products (for use only with grade 60 bars):
   1. “Lenton Terminator”, Erico Products, Inc.
   2. Or other Engineer-approved product.

2.04 FORMWORK MATERIAL

A. Rough-formed finished concrete: Unless otherwise specified, the default finish for formed surfaces shall be rough-form finish constructed with plywood, lumber, metal or other acceptable material. Lumber shall be dressed on at least two edges and one side for tight fit. The minimum grade be B-C, exterior grade.

B. Nails and Fasteners: Use only galvanized nails and fasteners for securing formwork in structures exposed to weather or unconditional spaces such as garages, canopies and porte-cocheres.

C. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on form and to minimize spalling of concrete on removal.

1. Exposed Surfaces: For surfaces designated with Class A and B finish tolerances, furnish units that will leave no portion of the tie closer than ¾ inch to the plane of the concrete surface and that will leave holes not larger than 1 inch (25.4 mm) in diameter in concrete surface when the ends or end-fasteners have been removed.
2. Dampproofed Surfaces: Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
3. Exposed to Weather or Unconditioned Space: Provide removable, glass-fiber-reinforced plastic, stainless steel, or galvanized form ties that will leave no corrodible metal closer than 1 ½ inches in surfaces that will be exposed to weather or in an unconditional space in the final structure. The ties shall leave no holes larger than 1 inch (25.4 mm) in diameter in concrete surfaces when the ends of end-fasteners are removed.

D. Chamfer Strips: Provide wood, metal, PVC, or rubber strips, ¾ by ¾ inch, minimum.

E. Formwork Coatings: Formwork coatings shall be not a commercial formulation that will not bond with, stain, not adversely affect concrete surfaces or impair subsequent treatment of concrete surfaces requiring bond or adhesion, not impede curing with water or curing compounds. Provide a product that has a maximum VOC (Volatile Organic Compounds) of 450 g/l but not greater than that permitted by the local government agency having jurisdiction in the area where the project is located. Products: Subject to compliance with requirements, provide one of the following:
1. “Enviroform”, Conspec Marketing and Manufacturing Co., Inc.
2. “Cast-Off WB”, Sonneborn Building Products.
3. “Farm Fresh”, Unitex.
4. “Formsheild WB”, Tamms Industries.
5. “Form-Eze natural”, The Euclid C]hemical Company, Inc.
6. “Bio-Form”, Universal Form Clamp.
7. “Aqua Blue”, US Spec.

2.05 RELATED MATERIALS

A. Waterstops: Provide waterstops at all construction joints and other joints in all foundation walls below grade and where shown on the drawings. Size to suit joints. Provide flat, dumbbell type or centerbulb type.
1. Polyvinyl chloride (PVC) waterstops: Corps of Engineers CRD-C 572. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
2. BoMetals, Inc.
   a. Greenstreak Group, Inc.
   b. Progress Unlimited, Inc.
   c. Vinylex Corp.
   d. Paul Murphy Plastics, Co.
   e. Sternson Group.
   f. Tamms Industries Co.; Div. Of LaPorte Construction Chemicals of North America, Inc.
   g. Westec Barrier Technologies; Div. Of Western Textile Products Inc.
3. Sodium Bentonite with Butyl Rubber: Volclay Waterstop RX manufactured by Cetco Building Materials Group.

B. Vapor Retarder: Provide vapor barrier chosen from products specified below over prepared base material where indicated.
1. Plastic Vapor Barrier: Provide a flexible, performed sheet membrane conforming to ASTM E1745 with the following properties:
   a. Class C material.
   b. Minimum of 15 mils (0.381 mm) thick.
   c. Maximum water vapor permeance rating of 0.04 as tested by ASTM E 96.
   d. Acceptable products include the following:
   e. “Stego Wrap Vapor Barrier 15 mil (0.381 mm)”; Stego Industries, LLC.

f. Refer to Specification Section 07 26 16 for additional information.

2. Tape for Plastic Moisture Retarders: High-density polyethylene tape with pressure sensitive adhesive having a minimum width of 4 inches (101.6 mm).

C. Absorbative Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C171:
1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.
4. Polyethylene-coated natural cellulose fabric such as “Aquacure” by Greenstreak Group, Inc.

E. Liquid Membrane-Forming Curing and Cuing and Sealing Compounds:
1. Water-Based Dissipating Resin Type Curing Compound: Curing Compound shall be a dissipating resin type, which chemically breaks down after approximately 4 weeks. Membrane forming compound shall meet ASTM C309, Types 1 and 1D Class B.
a. Products: Subject to compliance with requirements, provide one of the following:
1) “Kurez DR Vox” or “Kurez W Vox”; Euclid Chemical Company.
2) “L&M Cure R”; L&M Construction Chemicals.
3) “Horcure WB 30”; Tamms Industries.
4) “Hydro Cure 309”; Unitex.
5) “Sealtight 1100-Clear”; W.R. Meadows.
6) “US Spec Maxcure Resin Clear”; US Mix Co.
b. Submit manufacturer’s certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instruction that must be followed prior to any subsequent surface treatments and floor coverings.
2. High Solids, Water-Based, Non-Yellowing Curing and Sealing Compound: Water based membrane-forming curing and sealing compound, acrylic type, complying with ASTM C1315, Type 1, Class A classified as low odor. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, resilient flooring, vinyl-backed carpet, wood terrazzo, epoxy overlays or adhesives, or other coating or finishing products.
a. Products: Subject to compliance with requirements, provide one of the following:
1) “Super Diamond Clear Vox”; Euclid Chemical Company.
2) “Lumiseal 30 WB”; L&M Construction Chemicals.
3) “Kure 1315”; BASF Building Systems.
4) “Hydro Seal 30”; Unitex.
5) “Vocomp 30”; W.R. Meadows.
6) “US Spec Radiance UV-25”; US Mix Co.
7) “Luster Seal WB 300”; Tamms Industries.
b. Submit manufacturer’s certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

F. Evaporation Control: Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss in hot weather conditions.
1. Products: Subject to compliance with requirements, provide one of the following:
a. “Eucobar”; Euclid Chemical Company.
b. “E-Con”; L&M construction Chemical, Inc.
c. “Confilm”; BASF Building Systems.
d. “Sure Film (J-74)”; Dayton Superior.
e. “Sika Film”; Sika Chemical Co.

f. “Pro-Film”; Unitex.
g. “Sealtight Evapre”; W.R. Meadows.
h. “US Spec Monofilm ER”; US Mix Co.

2. Submit manufacturer’s certification that product conforms to the requirements specified and is compatible with all coverings and surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

G. Bonding Compound: Polyvinyl acetate or acrylic base, for use in cosmetic and/or nonstructural repairs. Products: Subject to compliance with requirements, provide one of the followings:

1. Acrylic or Styrene Butadiene:
   a. “Day-Chem Ad Bond (J-40)”; Dayton Superior.
   b. “SBR Latex”; Euclid Chemical Co.
   c. “Daraweld C”; W.R. Grace.
   d. “Acrylic Additive”; BASF Building Systems, Inc.
   e. “SikaLatex”; Sika Chemical Co.
   f. “Intralok”; W.R. Meadows.
   g. “US Spec Acrylcoat”; US Mix Co.
   h. “Akkro 7-T”; Tamms Industries.
2. Polyvinyl Acetate (Interior Use Only):
   a. “Euco Weld”; Euclid Chemical Co.
   b. “Everweld”; L&M Construction Chemicals, Inc.
   c. “Superior Concrete Bonder (J-41)”; Dayton Superior.
   d. “US Spec Bondcoat”; US Mix Co.

H. Epoxy Products: Two component material suitable for use on dry or damp surface, complying with ASTM C 881, for use in all structural concrete repairs.

1. Products for Crack Repair:
   a. “Sikadur 35 Hi Mod LV”; Sika Chemical Company – injection type.
   b. “Sikadur 52”; Sika Chemical Company – injection type.
   c. “Sikadur 55 SLV”; Sika Chemical Company – gravity feed.
   d. “Eucopoxy Injection Resin”; Euclid Chemical Company.
   e. “Sure-Inject (J-56)”; Dayton Superior.
   f. “Epofil SLV”; BASF Building Systems.
   g. “ETI-LV” or “ETI-GV”; Simpson Strong-Tie Co., Inc. – injection type.
   h. “Pro-Poxy 100 LV” or “Pro-Poxy 50”; Unitex.
   i. “Crackbond”; U.S. Anchor Corp.
   j. “Rezi-Weld LV”; W.R. Meadows.
   k. “US Spec Maxibond”; US Mix Co. – injection or gravity feed.
   l. “US Spec Eposeal LVS”; US Mix Co. – gravity feed.
   m. “Duralcrete LV”; Tamms Industries.
2. Products for Epoxy Mortar Patches:
   a. “Sikadur Lo-Mod LV”; Sika Chemical Corporation.
   b. “Euco 352 LV”; Euclid Chemical Company.
   c. “Sure Grip Epoxy Grout (J-54)”; Dayton-Superior.
   d. “Epofil”; BASF Building Systems.
   e. “Pro-Proxy 2500”; Unitex.
   f. “Rezi-Weld 1000”; W.R. Meadows.
   g. “US Spec EPM 3000”; US Mix Co.
   h. “Duralcrete LV”; Tamms Industries.
3. Products for Epoxying Steel Plates to Concrete: Conform to ASTM C 881-90, Type IV, Grade 3, Class A, B, & C except gel times.
   a. “Sikadur 31 Hi-Mod Gel”; Sika Corporation.
   b. “Euclid 425 Gel”; Euclid Chemical Company.
   c. “Sure Anchor I (J-S1)”; Dayton Superior.

d. “Epo Gel” or “Rapid Gel”; BASF Building Systems.
e. “Pro-Poxy 200”; Unitex.
f. “US Spec Gelbond NS”; US Mix Co.
g. “Duralcrete Gel”; Tamms Industries.

4. Products for Adhesive Anchors or Reinforcing Steel in Normal-weight Concrete: Product that conforms to ASTM C 881-02, Type IV, Grade 3, Class A, B, & C except gel times, and that is dispensed from a two-component cartridge system through a mixing nozzle that thoroughly mixes the two components as it is injected into the hole. The product must show approval by the ICC Evaluation Service of having passed Acceptance Criteria 308 as evidence by an Evaluation Service Report (ESR). Consultant with the manufacturer for the minimum temperature of the concrete surface allowed.
   a. Normal-weight concrete:
      1) “HIT-RE 500-SD”, Hilti Fastening Systems.
   b. “SET-XP” Adhesive”, Simpson Strong-tie.
      1) “PE 1000+”, Powers Fasteners, Inc.
   c. Light-weight Concrete: No approved products.
   d. These products may not be used in concrete cast over corrugated deck.
5. Substitutions for products noted in the drawings may be considered provided complete technical information and job references are furnished to the Engineer for approval prior to commencement of work. Failure to obtain approval for anchor substitutions will render the contractor liable for the design and performance of the anchor.

I. Self-Leveling Mortars, Underlayment Compound: Freeflowing, self-leveling, pumpable cementations base compound.
1. Products: Unless specified otherwise, provide one of the following:
   a. “Sonoflow”; BASF Building Systems, Inc.
   b. “Sikatop 111”; Sika Chemical Co.
   c. “Flo-Top” or “Flo-Top 90”; Euclid Chemical Co.
   d. “Levelaver I”; Dayton Superior.
   e. “US Spec Self-leveling Underlayment”; US Mix Co.
   f. “Level Magic”; Tamms Industries.

J. Polymer Patching Mortar: Polymer and microsilica modified cementitious based compounds.
1. Products:
   a. Horizontal
2. “This Top Supreme, Concrete Top Supreme”; Euclid Chemical.
      1) “Sikatop 121 or 122”; Sika Chemical.
      2) “Emaco R310CI”; BASF Building Systems.
      3) “Sonopatch 100 or 300”; BASF Building Systems.
      4) “US Spec H2 or NuTop”; US Mix Co.
      5) “Speed Crete PM”; Tamms Industries.
   b. Vertical or Overhead
      1) “Verticoat/Verticoat Supreme”; Euclid Chemical.
      2) “Sikatop 123”; Sika Chemical.
      3) “Emaco R350 CI”; BASF Building Systems.
      4) “Sonopatch 200”; BASF Building Systems.
      5) “US Spec V/O Patch”; US Mix Co.
      6) “Speed Crete PM”; Tamms Industries.

K. High Strength Flowing Repair Mortar: For forming and pouring structural members, or large horizontal repairs, provide flowable one-part, high strength microsilica modified repair mortar with 3/8” aggregate. The product shall achieve 9000 psi (62052.84 kPa) @ 28-days at a 9-inch slump.
1. Products:
   a. “Road Patch”; BASF Building Systems.

b. “US Spec STR Mortar”; US Mix Co.
c. “Eucocrete”; Euclid Chemical Co.
d. “Form and Pour”; Tamms Industries.

L. Anti-Corrosive Epoxy/Cementations Adhesive: Water-based epoxy/cementitious compound for adhesion and corrosion protection or reinforcing members (20 hour maximum open time).
1. Products:
a. “Corr-Bond”; Euclid Chemical Co.
b. “Armatec 110”; Sika Chemical Co.
2. “Sonoprep Plus”; BASF Building Systems.

M. Expansion Anchors in Concrete:
1. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICCES) with a published Evaluation Report showing having passed Acceptance Criteria 193 and approval for use in cracked concrete and resisting wind and seismic loads shall be approved for use.

N. Type: All expansion anchors in concrete shall be only wedge type expansion, sleeve type expansion or undercut type bolts.
1. Interior Use: All expansion anchors, nuts and washers for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z325C, Type II, Class 3.
2. Exterior or Exposed Use: All expansion anchors, nuts and washers for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized bolts, nuts and washers shall conform to ASTM A153. Stainless steel bolts shall be manufactured from 300 series stainless steel and nuts and washers from 300 series or Type 18-8 stainless steel.
3. Nuts and Washers: Nuts and washers shall be furnished from the manufacturer and used with the bolts.
4. Acceptable Products and Manufacturers – Normal and Lightweight Concrete:
a. “Kwik Bolt TZ”; “HDA Undercut Anchor” and “HSL-3 Heavy Duty Sleeve Anchor”, Hilti Fastening Systems.
b. “Strong-Bolt Wedge Anchor”; Simpson Strong-Tie, Co. Inc.
c. “Red Head Trubolt + Wedge Anchor”, ITW Red Head; “DUC Undercut Anchor”, USP Structural Connectors “Power Stud + SD2”; Powers Fasteners, Inc.
d. “SRS TZ Carbon Steel Anchor”; MKT Metall-Kunststoff-Technik.
e. “Torq-Cut Self Undercutting Anchor”; Simpson Strong-Tie, Co. Inc. (ESR Pending)
5. Acceptable Products and Manufacturers – Normal and Light Weight Concrete on Corrugated Deck:
6. “Kwik Bolt TZ”; Hilti Fastening System.
a. “Strong-Bolt Wedge-Anchor”; Simpson Strong-Tie, Co. Inc.
1) “Power Stud” + SD2”; Powers Fasteners, Inc.
7. Substitutions for products noted in the drawings may be considered provided complete technical information and job references are furnished to the Engineer for approval prior to commencement of work. Failure to obtain approval for anchor substitutions will render the contractor liable for the design and performance of the anchor.

O. Screw Anchors in Concrete:
1. Approvals: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published Evaluation Report showing having passed Acceptance Criteria 193 and approved for use in cracked concrete and resisting wind and seismic loads shall be approved for use.
2. Interior Use: All screws anchors for use in interior condition environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, class 3.

3. Exterior pr Exposed Use: All screw anchors for use in exposed of potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel.
4. Acceptable Products and Manufacturers – All Conditions:
   a. "Titen HD"; Simpson Strong-Tie Co. Inc.
   b. "Snake + Anchor"; Powers Fasteners, Inc.

P. "Wedge-Bolt+"; Powers Fasteners, Inc. (greater than ¼ in. diameter)
1. Substitutions for products noted in the drawings may be considered provided complete technical information and job references are furnished to the Engineer for approval prior to commencement of work. Failure to obtain approval for anchor substitutions will render the contractor liable for the design and performance of the anchor.

Q. Threaded Rods chemically Anchored in Concrete:
1. Type: Threaded rods installed in holes using a chemical anchoring process shall have a 45º chiseled end on one end.
2. Interior Application: Meet the requirements of ASTM A307, A 36 or A 193, grade B7.
3. Exterior Application: Meet the requirements of ASTM A 153 galvanized steel, or F 593, Group 1 or 2, condition CW stainless steel.

R. Reglets: Where resilient or elastomeric sheet flashing or bituminous membrane is terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

S. Contraction and Construction Joint-Filler Material for Slabs-on-Grade: Provide a 2- component semi-rigid, 100% solids epoxy having a minimum shore A hardness of 75 when tested in accordance with ASTM D2240. Subject to compliance with requirements, provide one of the following:
1. "Euco 700"; Euclid Chemical Co. Inc.
2. "Spec-Joint CJ"; Conspec Marketing and Manufacturing Co. Inc.
3. "Masterfill 300 I"; BASF Building Systems.
4. "MM-80"; Metzger/McGuire Co.
5. "Rezi-Weld Flex"; W.R. Meadows.
6. "US Spec SR-50 EJF"; US Mix Co.

T. Joint-Filler Strips for Isolation Joints in Slabs-on-Grade: ASTM D1751, asphaltsaturated cellulosic fiber, or ASTM D1752, cork or self-expanding cork.

U. Bondbreaker for Construction Joints in Slabs-on-Grade: A dissipating bondbreaking compound containing no silicones, resins, or waxes, and that conforms to ASTM C309. Subject to compliance with requirements, acceptable manufacturers include the following:
1. "Sure-Lift"; Dayton Superior Corporation, Inc.
2. "Tilt-Eez"; Conspec Marketing and Manufacturing Co. Inc.

2.06 PROPORTIONING AND DESIGN OF CONCRETE MIXES

A. The Contractor shall submit approval by the Engineer and Owner's Testing Laboratory, at least 15 working days prior to the start of construction, concrete mix designs and the Concrete Mix Design Submittal Form located at the end of this specification section for each class of concrete indicated on the structural drawings and in the Specifications. If required, the Contractor shall engage the services of an independent Testing Laboratory to assist in preparing the mix design. The Contractor shall not begin work with a particular mix until that mix design is has been approved.

B. The Contractor, acting in conjunction with his Concrete Supplier and his Testing Laboratory, shall submit in writing, with his mix designs, the method used to select mix proportions. Either of the following methods, as outlined in ACI 301, may be used.
1. Field Experience Method.
2. Laboratory Trial Mixture Method.

C. Required types of concrete and compressive strengths shall be as indicated in the Structural Drawings.

D. All mix designs shall state the following information:
   1. Mix design number or code designation by which the Contractor shall order the concrete from the Supplier.
   2. Structural slab or member for which the concrete is designed (i.e. columns, shear walls, footings, slab on grade, etc.).
   3. Wet and dry unit weight.
   4. 28 day compressive strength.
   5. Aggregate type, source, size, gradation, fineness modulus.
   6. Cement type and brand.
   7. Fly ash or other pozzolan type and brand (if any).
   8. Admixtures including air entrainment, water reducers, high-range water reducers, accelerators, and retarders.
   9. Design Slump or Slump/Flow.
   10. Proportions of each material used.
   11. Water/Cementitious ratio and maximum allowable water content.
   12. Method by which the concrete is intended to be placed (bucket, chute, or pump).
   13. Required average strength qualification calculations per ACI 301 4.2.3.3a and 4.2.3.3b. Submit separate qualification calculations for each production facility that will supply concrete to the project.
   14. Documentation of Average strength (trial mix data or field test data) per ACI 301: When field test data is used to qualify average strength, submit separate documentation for each production facility that will supply concrete to the project.
   15. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Agency's reports from which the data was complied.
   16. All other information requested in the Concrete Mix Design Submittal Form located at the end of this specification section.

E. Low Alkali Concrete: The total alkali contribution from cementitious materials in the concrete mix shall not exceed 4.0 pounds per cubic yd of concrete unless the aggregate used is certified to contain no deleterious materials that react with alkalis in the concrete mix as defined in ASTM C 33. This requirement may be met by the use of low-alkali cement.

F. Supplementary Cementitious Materials: Fly ash replacement of Portland cement shall not exceed 25% unless otherwise approved. If fly ash is used, it must be at a minimum fly ash replacement level of 15%. Approved for higher levels will be based on showing experience of satisfactory performance on other projects using materials from identical sources as proposed for this project. Submit evidence of such experience on other projects.

G. Aggregate: Comply with the following special requirements:
   1. For slabs and other designated concrete, combined aggregate gradation shall be 8% - 18% for large top size aggregates 1 inch (25.4 mm). or 1/2 inch (12.7 mm).) or 8% - 22% for smaller top size aggregates (1 in. or 3/4 inch (19.05 mm).) retained on each sieve below the top size and above the No. 100. Deviations from this gradation may be allowed upon the approval of the Engineer subject to the following limitations:
      a. The percent retained on two adjacent sieves shall not be less than 5%.
      b. The percent retained on three adjacent sieves shall be not less than 8%.
      c. If the percent retained on two adjacent sieves is less than 8%, the total percent retained on either of those sieves and the adjacent outside sieve shall be not less than 13%.

H. Admixtures:
   1. Admixtures to be used in concrete shall be subject to the approval of the Engineer and Owner's Testing Laboratory and shall be used for the purpose intended by the manufacturer to produce concrete to meet the specified requirements.

2. Quantities of admixtures to be used shall be in strict accordance with the manufacturer's instruction.

I. Adjustments of Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such mix design adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved mix designs including changes in admixtures shall be submitted in writing with the specified Concrete Mix Design Submittal Form to the Engineer and Owner's Testing Laboratory for approval prior to field use.

J. Chloride Ion Content: A written submittal shall be made with each mix design proposed for use on the project that the chloride ion content from all ingredients including admixtures will not exceed the limits specified in this section of the Specifications.

2.07 CONCRETE MIXES

A. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94, "Ready Mix Concrete" and Testing Laboratory section of the specifications.

PART 3 EXECUTION

3.01 FABRICATION AND CONSTRUCTION OF FORMWORK

A. Design, erect, support, brace and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic construction loads that might be applied until the concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Maintain formwork construction tolerances complying with ACI 117.

C. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping my damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to supports screed strips; use strike-off templates or compacting-type screeds.

F. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and patch forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

G. Chamfer exposed corners and edges as indicated, using specified chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

H. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recess and chases from trades providing such items. Accurately place and securely support items built into forms.

3.02 CLEANING AND TIGHTENING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove ships, wood, sawdust, dirt, and all other debris just prior to concrete placement. Retighten forms and bracing prior to concrete placement as required to prevent mortar leaks and maintain proper alignment.

3.03 CLEANING AND RE-USE OF FORMS

A. Forms reused in the work shall be repaired and cleaned. Split, frayed, delaminated, or otherwise damaged facing material will not be acceptable for exposed surfaces. Forms intended for successive concrete placement shall have surfaces cleaned, fins and laitance removed, and joints tightened to avoid surface offsets. New form coating compound shall be applied to reuse forms. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-staining steel formwork is not acceptable.

3.04 TOLERANCES

A. Unless specified otherwise, all tolerances for concrete formwork shall conform to ACI Standard 117, "Standard Tolerances for Concrete Construction and Materials". Before concrete placement the Contractor shall check lines and levels of erected formwork and make any corrections and adjustments as required to ensure proper size and location of concrete members and stability of forming systems. During concrete placement the Contractor shall check formwork and supports to ensure that forms have not displaced and that completed work will be within specified tolerances.

B. Construct forms so as to limit the offset between adjacent pieces of formwork facing material in accordance with the following classifications as defined in ACI 117. The offset limits shall apply to both abrupt and gradual variations in the surface.

1. Class C, ½ inch, other surfaces exposed to view but not scheduled to receive other finishes.
2. Class D, 1 inch (25.4 mm), all other surfaces.

3.05 REMOVAL OF FORMS AND SUPPORTS

A. Records of Weather Conditions: The General Contractor shall be responsible for keeping records of weather conditions to be used in the decision on when to remove forms.

B. Formwork Not Supporting Concrete: Formwork not supporting concrete such as sides of walls and similar parts of the structure, may be removed after cumulatively (not necessarily consecutively) curing at not less than 50°F for 12 hours after placing concrete, provided the concrete is sufficiently hard so as not to be damaged by form removal operations and provided curing and protection operations are maintained. If ambient air temperatures remain below 50°F, if retarding agents are used, or if Type II and Type V Portland cement is used, then this specified minimum period should be increased as required to safely remove the forms without damage to the concrete. Where such forms also support formwork for slab or beam soffits, the removal times of the latter shall govern.

3.06 FABRICATION AND DELIVERY OF REINFORCEMENT

A. Bending and Forming: Fabricate bars of indicated sized and accurately form to shapes and lengths indicated and required, by methods not injurious to materials. Do not heat reinforcement for bending. Bars shall be free from injurious defects, have a workmanlike finish with no excessive rust and/or pitting and have no unusual kinks or bends.

B. Marking and Shipping: Bundle reinforcement and tag in accordance with section 7.4.5 of the CRSI "Manual of Standard Practice". Transport and store at site so as not to damage material. Keep sufficient supply of tested, approved and proper reinforcement at the site to avoid delays. Maintain reinforcing bars free of mud, dirt, grease, or other coating.

3.07 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Stel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.

B. Before placing and again before concrete is placed, clean reinforcement of loose rust and mill scale, earth, ice and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs, runners, bolsters, spacers and hangers, as required. Exercise particular care to maintain proper distance and clearance between parallel bars and between bars and forms. Provide metal spreaders and spacers to hold steel in position. Support steel at proper height upon approved chairs.

D. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Support of Spread Footing Reinforcing Steel.
   1. Bottom Steel: Support bottom reinforcing mat to provide the specified clearance to the bars. Spacing between supports shall not exceed 4’-0” centers each way.
   2. Top Steel: Support top reinforcing on steel angle frames bracing in both directions or on special standee support bars. Spacing between supports shall not exceed 4’-0” centers each way. The depth of the supports shall provide the specified clearance from the bars to the top of the concrete. The design of the support steel shall be the responsibility of the Contractor.

F. Coordinating with other trades and expedite materials and labor to avoid omissions and delay.

G. Install waterproof membrane or vapor barrier as specified prior to placing steel for concrete slabs-on-grade.

H. Extend reinforcement continuous through construction joints unless otherwise shown on the drawings or, if approved on the shop drawings, provide dowels of sufficient length to develop the full tension or compression strength of the bar as applicable.

I. Slab-on-Grade Joint Dowel Bars: Support slab-on-grade joint dowel bars independently of support for slab reinforcement on soil supported slab bolsters or specially manufactured cradles such that dowel bar remains parallel to slab surface and at right angles to joint during concreting operations. Lightly coat the exposed end of the dowel with a paraffin-base lubricant, asphalt emulsion, form oil, or grease or use a dowel bar sleeve specifically manufactured for the purpose of preventing a bond between the dowel and the concrete.

J. Alternate Slab-on-Grade Joint Load Transfer Systems: Install the load transfer system in accordance with the manufacturer’s direction such that the horizontal plane of the flat plate is parallel to the plane of the subgrade on which the slab is bearing.

K. Provide and place additional reinforcing steel at all sleeves and openings in beams, slabs and walls as specified on the drawings. Where sleeves or openings not shown on the drawings interrupt the reinforcement, consult with Engineer for instruction for placing and splicing of bars. Provide required additional reinforcing steel at no additional cost to the Owner.

3.08 SPLICING REINFORCING STEEL

A. Provide splice type (tension lap splice, compression lap splice, compression end bearing splice, or mechanical anchorage tension splice) as indicated on the drawings. Splice reinforcing bars only at locations shown on the structural drawings and approved shop drawings. Unauthorized or unscheduled splices not approved by the Engineer on writing will not be accepted.

B. All lap splices in reinforcing steel shall be contact lap splices unless detailed otherwise on the drawings.

C. Maintain proper cover between reinforcing bars at splices.

D. Lap unscheduled reinforcing bars not otherwise specified a minimum of 30 day diameters at splices.

E. Manufacturer of mechanical tension splice should be present for first day’s installation.

3.09 WELDING REINFORCING STEEL

A. Welding reinforcing steel is permitted only where specifically shown on the drawings. All welding shall conform to AWS D1.4 “Structural Welding Code – Reinforcing Steel”. Only weldable reinforcing steel conforming to ASTM A 706 or deformed bar anchors conforming to ASTM A 496 shall be permitted. ASTM A 615 bars may not be welded for structural use.

B. Track welding of reinforcement shall only be allowed for preassemble mats and cages.

3.10 SLUMP LIMIT

A. The slump, as measured in the field where concrete cylinders are taken, shall be within plus or minus 1 inch (25.4 mm) of the design slump noted on the Mix Design Submittal Form. Water may be added to the concrete in the field only to the extent that the prescribed water/cementitious ratio noted in the Mix Design Submittal Form is not exceeded.

3.11 VAPOR BARRIER INSTALLATION

A. Install vapor barrier in accordance with ASTM E1643 and manufacturer’s instructions.

B. Seal all joint in the field with the specified pressure sensitive tape. Heat-welded joints done in a shop prior to delivery is an acceptable method to minimize the number of field joints.

C. Seal all pipe penetrations through the moisture retarder with a boot made from the moisture retarder material and tape.

3.12 JOINTS IN CONCRETE

A. Construction Joints: Locate and install construction joints as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Architect/Engineer.

1. Keyways: Provide keyways with a depth of one tenth of the member thickness (1 ½” minimum or as shown on the drawings) in construction joints only where shown on the drawings.
2. Joint Construction: Place construction joints in the center one third of grade beams and as shown on the drawings for slabs-on-grade and walls unless shown otherwise. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection. Place joints perpendicular top main reinforcement. Continue reinforcement across construction joints unless otherwise shown on the drawings. Dowels that cross construction joints shall be supported during concreting operations so as to remain parallel with the slab or wall surface and at right angles to the joint. Submit all construction joint locations as a shop drawing submittal.
3. Waterstops: Provide waterstops in construction joints as indicated on the Architectural and Structural Drawings. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer’s printed instructions.
4. Isolation Joints in Slabs-on-Ground: Construct isolation joints (without dowels) in slabs-on-ground at points of contact between slabs on ground and vertical surfaces only where specifically detailed on the drawings. Install joint-filler strips at joints where indicated. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated on the drawings. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together. Provide construction joints with dowels at all locations unless isolation joints are detailed.
5. Contraction (Control) Joints in Slabs-on-Ground and Unbonded Topping Slabs: Maximum joint spacing shall be 36 times the slab thickness or 20 feet (609.6 cm), whichever is less and at a minimum on column lines unless otherwise noted on the drawings. Use one of the two following methods (sawed or formed) to create the joints. Do not use the formed joint in areas subject to vehicular traffic.
   a. Sawed Joints.

1) Primary Method: Early-Entry, dry-cut method, by Soff-Cut International, Corona, CA (800) 776-3328. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within 1 to 4 hours, depending on air temperature, after final finish as soon as the concrete surface is firm enough to not be torn or damaged by the blade at each saw cut location. Use 1/8 inch (3.18 mm) thick blade, cutting 1 1/4" inch into the slab.
2) Optional Method (where Soff-Cut System method equipment is not available, subject to limitations): This method may not be used when there is no dowel passing through the contraction joint. Use a conventional saw to cut joints within 4 to 12 hours after finishing as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/8 inch (3.18 mm) thick blade, cutting to a depth of ¼ of the slab thickness but not less than 1 inch (25.4 mm). Cut to a depth of 1/3 slab thickness for slabs reinforced with steel fibers.

b. Formed Joints: Form contraction joints by inserting premolded plastic hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. The depth is to be ¼ the slab thickness, but not less than 1 inch (25.4 mm). Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
c. Joint Filler: Provide in both contraction and saw-cut construction joints when specified.
1) Remove dirt and debris from the joint by vacuuming immediately prior to filling joint. Clean the joint of curing compounds and sealers.
2) Filler material shall be applied to the joints when the building is under permanent temperature control, but no less than 90 days after slab construction.
3) Follow the manufacturer's recommended procedure for installing filler material. The joint filler must be flush with the adjacent concrete. A concave profile on the top of the joint filler is unacceptable and will be grounds for removal and replacement.
d. The Contractor shall protect the joints from damage caused by wheeled traffic or other sources during construction until a joint-filler material (if specified) has been installed.

3.13 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto unless directed otherwise by these specifications. Install reglets to receive top edge of foundation sheet waterproofing where specified by the Architect, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles and other conditions.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

C. Do not install sleeves in concrete slabs, pier caps, footings or walls except where shown on the structural drawings or approved by the Architect and Engineer.

D. Securely fasten embedded plates, angles, anchor rods and other items to be built into the concrete to the formwork or hold in place with templates. Insertion of these items into concrete after casting is prohibited.

3.14 CONCRETE PLACEMENT

A. Preplacement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

C. Comply with ACI 301 and as herein specified.

1. Deposit concrete continuous or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes or weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. Spread concrete using short-handled, square-ended shovels, or come-alongs.
2. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24” and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
3. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spacing, rodding or tamping. Use internal vibrators of the largest size and power that can properly be used in the work as described in the table entitled “Range of characteristics, performance, and applications of internal vibrators” found in ACI 301.
4. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6” into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedded of reinforcement and other embedded items without causing segregation of mix.
5. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
6. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners or forms, eliminating air and stone pockets that may cause honeycombing, pitting, or planes of weakness.
7. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats or darbies to smooth surface free of humps or hollows before excess moisture or bleedwater appears on the surface. Do not disturb slab surfaces prior to beginning finishing operations.
8. Maintain reinforcing in proper position during concrete placement operations.
9. Placing Concrete by Pump: If concrete is placed by using a pump, the grout used for pump priming must not become a part of the completed structure unless an engineered grout design mix and grout location are approved in advance by the Engineer.

3.15 FINISH OR FORMED SURFACES

A. Rough Form Finish: Provide rough form finish for formed concrete surfaces not otherwise scheduled on the drawings to receive a smooth-form finish. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4” in height rubbed down or chipped off.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.16 MONOLITHIC SLAB FINISHES

A. Place, consolidate, strike off, and level concrete, eliminating high spots and low spots, before proceeding with any other finish operation. Do not add water to the surface of the concrete during finishing operation.

B. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerance specified below. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms or rakes.

C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using a hand float, a bladed power float equipped with float shoes, or a powered disk float, when the bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit the operation. Check and level surface plane to a tolerance as specified below. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

D. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system. After floating, begin first trowel finish operation by hand or power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final handtroweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface to a tolerance as specified below. Grind smooth surface defects which would telegraph through applied floor covering system.

E. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thinset mortar, apply initial trowel finish as specified above, then immediately follow with slightly scarifying surface by fine brooming.

F. Slip-Resistive Broom Finish: Apply slip-resistive broom finish to ramps less than 6% slope, exterior concrete platforms, steps and ramps and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

G. Roller-Bug Finish: Provide a roller-bug finish with a minimum ¼” amplitude to all ramps exceeding a 6% slope. Extend the finish as least 12 feet (365.76 cm) beyond the beginning and ending of the greater-than-6% ramp. The finish shall be imprinted on the concrete by the use of a roller-bug tamper.

H. Finish of Top of Spread Footings and/or Mat Foundations
   1. Top Surface below Finished Slab: The top of the footing or mat shall be screeded level and smooth with a flatness F-number, FF15 (overall), FF10 (minimum local) and a levelness F-number, FL12 (overall), FL10 (minimum local).
   2. Top Surface as Finished Slab: The top surface of a footing or mat that is to serve as the finished slab in the building shall be leveled, cured, and surface prepared as specified for the finished floor construction appropriate to the space usage as defined in the Architectural Drawings.

3.17 CONCRETE FINISH MEASUREMENT AND TOLERANCES

A. Testing Procedure: ASTM E1155/E1155M:

B. Tolerance on Floor Elevations: Construction tolerance on absolute floor elevation from the specified elevation as shown on the drawings shall be as specified below, taken form ACI 117:
   1. Slab-on-Grade Construction - + ¾”.

2. Top surfaces of all other slabs - + ¾". The tolerance on relative elevation difference between points on the floor be defined by the FL Levelness F-number as prescribed below.

C. Random Traffic Floor Finish Tolerances:
1. Specified overall values for flatness (SOFF) and levelness (SOFL) shall conform to the values listed below for the floor surface classification noted for each slab category noted.

Floor Surface Classification	SOFF	SOFL
Conventional	19	13
Good	38	25
Flat	50	33
Very Flat	75	50
Super Flat	100	66
Ultra Flat	150	100

2. Minimum local values for flatness (MLFF) and levelness (MLFL) shall equal 3/5 of the SOFF and SOFL values, respectively, unless noted otherwise. The MLFF and MLFL values shall apply to the minimum areas bounded by the column lines and half-column lines, or the minimum areas bounded by the construction and contraction joints, whichever are the smaller areas.
3. The SOFL and MFLL tolerance values shall apply only to level slabs-on-ground. The Levelness tolerance numbers shall not apply to unshored slabs that deflect under self-weight.
4. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10 feet (304.8 cm) at any point.

D. Construction Requirements to Achieve Specified Floor Finish Tolerances:
1. Forms shall be properly leveled, in good condition and securely anchored including special attention to ends and transitions.
2. Bearing surfaces for straightedges such as form edges or previously poured slabs shall be kept clean of laitance, sand, gravel, or other foreign elements.
3. Screeds shall be maintained in good condition with true round rolling wheels and level cutting edges. The use of optical sighting equipment such as lasers is recommended for checking levelness and straightness. The Contractor shall promptly adjust or replace equipment when test results indicated substandard work.
4. Highway straightedges are recommended for use in lieu of bullfloats for all slab placement and finishing operations.

E. Contractor Responsibility for Concrete Floor Finish Requirements: Floor finish requirements shown below (flatness and levelness tolerances) are minimum requirements that apply unless stricter requirements are contained in instructions for installation of applied floor products in which case the Contractor is responsible for attaining the values prescribed by the manufacturer of such products.

F. Concrete Floor Finish Tolerance for Slab-on-Grade Construction:
1. Concrete Placement: Concrete shall be placed and screeded to predetermined marks set to elevation prescribed on the Drawings.
2. Finish Tolerance of Random Traffic Floor Surfaces:
   a. Slabs in nonpublic areas, mechanical rooms, slabs to receive thick-set tile or topping: Conventional.
   b. Carpeted Areas: Good.
   c. Exposed slabs in public spaces, slabs to receive this-set flooring: Flat.

G. Concrete Floor Finish Tolerance – Unshored Metal Deck on Shored or Unshored Steel Beam or Open-Web Joist Floor Construction:
1. Concrete Placement: Concrete over metal deck shall be placed and screeded level and flat to the tolerance specified below, maintaining at least the minimum slab thickness at all locations as specified on the drawings. The Contractor shall increase the slab thickness

as required to compensate for metal deck deflection, an din unshored beam construction, beam deflection in excess of actual beam, camber in order to achieve a level and flat floor within specified tolerances.

2. Finish Tolerance of Random Traffic Floor Surfaces:
   a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional.
   b. Carpeted Areas: Moderately Flat.
   c. Exposed slabs in public spaces, slabs to receive this-set flooring: Flat.
   d. Eighty percent (80%) of the final floor surface shall fall within an envelope of 0.75" centered about the mean elevation of all the readings. (± 0.375 about mean). The mean elevation of all readings shall not deviate from the specified design grade by more than ± 0.375".
3. Extra Concrete: The contractor shall include in his bid any additional concrete required to achieve the specified slab surface finish tolerance and to compensate for metal deck deflection, and for beam deflection in excess of actual beam camber.

H. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:
1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:
   a. The composite overall values of FF or FL of the entire floor installation measure less than specified values.
   b. Any individual test section measures less than the specified absolute minimum FF or FL value.
2. Modification of Existing Surface:
   a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately undertake the approved repair method.
   b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair and time to affect the repair.
3. Repair method(s), at the sole discretion of the Architect/Engineer or Owner's Representative, may include grinding (floor stoning), planning re-topping with self-leveling underlayment compound or repair topping, or any combination of the above.
   a. The Architect/Engineer or Owner's Representative maintains the right to require a test repair section using the approved method of repair for review and approval to demonstrate a satisfactory end product. If, in the opinion of the Architect/Engineer or Owner's Representative, the repair is not satisfactory an alternate method of repair shall be submitted or the defective area shall be replaced.
   b. The judgement of the Architect/Engineer or Owner's Representative on the appropriateness of a repair method and its ability to achieve the desired end product shall be final.
   c. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.
4. Removal and Replacement:
   a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately commence to remove and replace the defective work.
   b. Replacement section boundaries shall be made to coincide with the test section boundaries as previously defined.
   c. Sections requiring replacement shall be removed by saw cutting along the section boundary lines to provide a neat clean joint between new replacement floor and existing floor.

d. The new section shall be reinforced the same as the removed section and doweled into the existing floor as required by the Engineer. No existing removed reinforcing steel may be used. All reinforcing steel shall be new steel.
e. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.
f. The judgement of the Architect/Engineer or Owner's Representative on the need for replacement shall be final.
g. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3.18 CONCRETE CURING AND PROTECTION

A. General:
1. Protect freshly placed from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete. Apply evaporation retarder if hot, dry and windy weather causes rapid moisture loss exceeding 0.2 lb./sq. ft. x hr before and during finishing operations. Apply in accordance with manufacturer's instructions after screeding and bull floating and troweling.
2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be 7 days for all concrete except high early strength concrete which shall be cured for 3 days minimum. Alternatively, curing times may be reduced if either of the following provisions is complied with:
a. If tests are made of cylinders kept adjacent to the structure and cured by the same methods, curing measures may be terminated when the average compressive strength has reached 70% of the specified 28 day compressive strength.
b. If the temperature of the concrete is maintained at a minimum of 50°F for the same length of time required for laboratory cured cylinders of the same concrete to reach 85% of the 28 day compressive strength, then curing may be terminated thereafter.
c. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period.

B. Curing Formed Surfaces: Where wooden forms are used, cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by one or a combination of the methods specified below, as applicable.
1. Basement Walls, Sides of Exterior Retaining Walls: Mist cure in forms or by one or a combination of methods 1, 2 or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C309, type 1, class A or B for method 3.

C. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping and other flat surfaces by one or a combination of the methods specified below, as applicable. The Contractor shall choose a curing method that is compatible with the requirements for subsequent material usage on the concrete surface.
1. Floors Directly Exposed to Vehicular or Foot Traffic not in Parking Areas and not otherwise receiving a chemical hardener or penetrating sealer finish: Apply two coats of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C1315, type 1, Class A in accordance with method 3 below as specified below.
2. Floors in Non-Public spaces that are left exposed to view and not receiving sealers or hardeners, floors involved in under-floor air distribution systems: Apply one coat of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C1315, type 1, Class A or B in accordance with method 3 below a s specified below.
3. Floors that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, acrylic terrazzo, vinyl composition tile, sheet vinyl, linoleum, vinylbacked carpet,

rubber, athletic flooring, synthetic turf, wood, epoxy overlay or adhesive, or other coating or finishing products: Cure using methods 2 or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C309, type 1, class A or B for method 3.

4. All other Surfaces: Cure using methods 1, 2, or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C309, type 1, class A or B for method 3.

D. Curing Methods
   1. Method 1 – Moisture Curing: Provide moisture curing by one of the following methods:
      a. Keep concrete surface continuously wet by covering with water.
      b. Continuous water-fog spray.
      c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorbative cover to provide coverage of concrete surfaces and edges, with 4” lap over adjacent absorptive covers.
   2. Method 2 – Moisture-Retaining Cover Curing: Provide moisture-retaining cover curing as follows:
      a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3” and sealed by waterproofed tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Water may be added to concrete surface to prevent drying before the cover is installed, but the surface shall not be flooded with water if a non-absorptive cover is used.
   3. Method 3 – Curing or Curing and Sealing Compound: Provide curing, curing/hardener, liquid membrane-forming curing, or curing and sealing compound as follows:

E. Apply specified compound to concrete slabs as soon as final finishing operations are complete (within 2 hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer’s directions. Do not allow to puddle. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period. Apply second coat for sealing 2 to 3 hours after the first coat was applied. Do not use membrane-forming curing and sealing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, damproofing, membrane roofing, flooring (such as ceramic or quarry tile, glued-down carpet, vinyl composition tile, linoleum, sheet vinyl, rubber, athletic flooring, synthetic turf, epoxy overlay or adhesive, or wood), paint or other coatings and finish materials. Dissipating resin type cures are acceptable in these locations.

3.19 HOT OR OTHER ADVERSE WEATHER CONCRETING

A. Definition:
   1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. If conditions cause as evaporation rate of 0.2 lb./sq. ft./hr. as calculated by Figure 2.1.5 inch (38.1 mm) ACI 305R-99, then precautions shall be taken to prevent plastic shrinkage cracks from occurring.
   2. The maximum acceptable concrete temperature at the truck discharge point shall be 95°F.

B. Specification: Follow hot weather concreting practices specified below when required to limit the concrete temperature at the truck discharge point to the stated maximum acceptable temperature.

C. Records: Under hot weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature at truck discharge and general weather conditions.

D. Hot Weather Concreting Requirements: The following items, all or in part as required, shall be followed to limit the concrete temperature to the stated maximum acceptable temperature and to minimize the possibility of plastic shrinkage cracks from developing.
   1. Design the concrete mixes specifically for hot weather conditions replacing some cement with fly ash or other pozzolan and using a water reducing retarding admixture (ASTM C 494 Type D).
   2. Use the largest size and amount of coarse aggregate compatible with the job.
   3. Use sunshades and/or windbreaks.
   4. Delay construction of indoor slabs-on-grade until the walls and roof are constructed.
   5. Cool and shade aggregate stockpiles.

E. Use ice as part of the mixing water or cool the water with liquid nitrogen.
   1. Limit the number of revolutions at mixing speed to 125 maximum.
   2. Reduce time between mixing and placing as much as possible.
   3. Do not add water to ready-mixed concrete at the job site unless it is part of the amount required initially for the specified water-cement ratio and the specified slump.
   4. Schedule concrete placement for early morning, late afternoon, or night.
   5. Have all forms, equipment and workers ready to receive and handle concrete.
   6. Maintain one standby vibrator for every three vibrators used.
   7. Keep all equipment and material cool by spraying with water including exteriors of forms, reinforcing steel, subgrade, chutes, conveyors, pump lines, tremies, and buggies.
   8. Protect slab concrete at all stages against undue evaporation by applying a fog spray or mist above the surface or applying a monomolecular film. Where high temperatures and/or placing conditions dictate, use water-reducing retarding admixture (Type D) in lieu of the water-reducing admixture (Type A) as directed by the Owner's Testing Laboratory.
   9. Provide continuous curing, preferably with water, during the first 24 hours using wet burlap, cotton mats, continuous spray mist, or by applying a curing compound meeting ASTM C 12315. Continue curing for 3 days minimum.
   10. Cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature immediately before placement of concrete.
   11. As soon as possible, loosen forms and run water down the inside. When forms are removed, provide a wet cover to newly exposed surfaces.

3.20 COLD OR OTHER ADVERSE WEATHER CONCRETING

A. Definition:
   1. Concrete shall not be placed when the outside air temperature is 40°F or less unless cold weather concreting practices are followed as specified below.
   2. Cold weather concreting practices should also be followed whenever the average daily air temperature is less than 40°F for more than three successive days. The average daily air temperature is the average of the highest and lowest temperature occurring during the period from midnight to midnight. The requirement for adhering to these cold-weather concreting practices may be terminated when the air temperature is above 50° F for more than half of any 24h duration.
   3. The temperature of the concrete immediately after placing shall be no less than and no more than 20° greater than the following temperature:
      a. 55° F for sections less than 12 inch (304.8 mm). in the least dimension.

B. 50° F for sections 12 to 36 inch (914.4 mm). in the least dimension.
      a. 45° F for sections 36 to 72 inch (1828.8 mm). in the least dimension.
      b. 40° F for sections greater than 72 inch (1828.8 mm). in the least dimension.
   2. Protect the concrete immediately after placing and during the curing period such that the concrete does not freeze nor fall below the temperature levels stated in the above paragraph. When removing protection, the maximum decrease in temperature measured at the surface of the concrete in a 24 hour period shall not exceed the following:
      a. 50° F for sections less than 12 inch (304.8 mm). in the least dimension.

b. 40° F for sections 12 to 36 inch (914.4 mm). in the least dimension.
c. 30° F for sections 36 to 72 inch (1828.8 mm). in the least dimension.
d. 20° F for sections greater than 72 inch (1828.8 mm). in the least dimension.

3. The maximum concrete temperature heated by artificial means at point of placement shall not exceed 90°F.

C. Records: under cold weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature as placed and general weather conditions.

D. Cold Weather Concreting Requirements: The following items, all or in part as required, should be followed to assure acceptable concrete in cold weather conditions:

1. Design the concrete mix suitable for cold weather. Use air entrainment (where not prohibited) and obtain high early strength by using a higher cement content, a high early strength cement (Type III), or as specified non-chloride accelerator (ASTM C 494 Type C or E).
2. Protect the concrete during curing period using insulating blankets, insulated forms, enclosures and/or heaters.
3. Concrete cured in heated enclosures shall have heaters vented to prevent exposure of concrete and workmen to noxious gases.
4. Frozen subgrade shall be thawed prior to concrete placement and snow and ice shall be removed from forms.
5. Concrete shall be protected and cured at 50°F for seven days minimum if normal concrete (Type I cement) is used and for three days minimum if high early strength concrete (concrete with Type III cement, 100 pounds cement added per cubic yard concrete, or a non-chloride accelerator added).
6. Concrete not loaded during construction shall be protected a minimum of 3 days for normal concrete and 2 days for high early strength concrete to obtain safe from stripping strength. Concrete fully loaded during construction shall be protected for whatever time period is required to obtain the required strength as determined by nondestructive strength tests (Windsor probe, Swiss Hammer Test) on the in-place concrete.
7. Heat the mixing water and then blend hot and cold water to obtain concrete no more than 10°F above the required temperature.
8. Heat the aggregates by circulating steam in pipes placed in the storage bins for air temperatures consistently below 32°F. When either water or aggregate is heated to over 140°F combine them in the mixer first to obtain a maximum temperature of the mixture not to exceed 140°F in order to prevent flash set to the concrete.
9. Uniformly thaw aggregates far in advance of batching to prevent moisture variations in the stockpile.
10. Cover warmed stockpiles with tarps to retain heat.
11. Place air entraining admixture in the batch after the water temperature has been reduced by mixing with cooler solid materials.
12. Use wind screens to protect concrete from rapid cooling.
13. Place vertical pump lines inside the building, if possible, for concrete being pumped.
14. Maintain artificial heat as low as possible to reduce temperature stresses during cooling.
15. Avoid water curing of concrete except for parking garage structures. Apply the required curing compound to unformed surfaces as soon as possible to prevent drying of concrete from heated enclosures.
16. Delay from stripping as long as possible to help prevent drying from heated enclosures and to reduce damage to formed surfaces caused by premature stripping.
17. Provide triple thickness of insulating materials at corners and edges vulnerable to freezing.
18. Wrap protruding reinforcing bars with insulation to avoid heat drain from the warm concrete.
19. Gradually reduce the heat at the end of the heating period to reduce the likelihood of thermal shock.

3.21 SHRINKAGE AND TEMPERATURE REINFORCEMENT

A. Provide shrinkage and temperature reinforcement (as required by ACI 318) at right angles to main top and bottom bars for all structural slabs unless detailed otherwise on the drawings.

3.22 PLACEMENT OF COLUMN DOWELS AND ANCHOR RODS

A. Dowels for columns, plinths, and pilasters and anchors rods shall be accurately set using 1/8" thick steel templates.

3.23 REINFORCEMENT IN COMPOSITE METAL DECK SLAB

A. Composite metal deck slabs shall be reinforced as indicated on the drawings.

B. Extra Reinforcement Over Girders: Provide additional reinforcing steel over interior girders as shown on the drawings.

C. Placement of Slab Reinforcement: Provide bolsters, high chairs, and/or additional reinforcing as shown in details on the drawings to support the reinforcing with the clear cover shown on the details.

3.24 REINFORCEMENT AROUND OPENINGS IN COMPOSITE METAL DECK SLABS

A. For all openings in metal deck not framed with structural steel and greater than 10" in width in either direction, provide additional reinforcing steel as shown in details on the drawings.

3.25 REINFORCING IN GRADE BEAMS

A. Provide reinforcement in grade beams as shown on the drawings.

B. Bar Support for Grade Beam Cages: Grade beam bottom steel shall be supported at 5'- 0" maximum centers using beam bolsters that provide 3" bottom cover to the reinforcing steel. Beam bolsters used shall be designed and manufactured for support on soil.

3.26 REINFORCEMENT IN TOPPING SLABS

A. Provide bar reinforcing in slabs as shown on the drawings.

3.27 REINFORCING IN HOUSEKEEPING PADS

A. Provide bar reinforcing in housekeeping pads as shown on the drawings.

3.28 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp and finish concrete surfaces as scheduled.

E. Installation of Adhesive Anchors Using Injectable Epoxy or Adhesive: A representative of the adhesive manufacturer shall be present for the first three holes that are drilled and filled with adhesive. After drilling the hole to the diameter and depth recommended by the manufacturer, clean the hole with a wire or nylon brush. Blow the dust out of the hole using compressed air with a nozzle that reaches to the bottom of the hole. When using adhesive from a new pack, the adhesive that is discharged from the mixing nozzle should be a uniform gray color before any adhesive is installed in the hole. Fill the hole with adhesive starting from the very bottom of

the hole until the hole is about 2/3 full. Do not leave an air pocket at the bottom of the hole. Insert the anchor rod or dowel by slowly twisting it into the hole.

3.29 CONCRETE SURFACE REPAIRS

A. Definition – Defective Areas:
   1. Formed Surfaces: Concrete surfaces requiring repairs shall include all honeycombs, rock pockets and voids exceeding 1/4" in any dimension, holes left by tie rods or bolts, cracks in excess of 0.01" and any other defects that affect the durability or structural integrity of the concrete.
   2. Unformed Surfaces: Concrete surfaces requiring repair shall include all surface defects such as crazing, cracks in excess of 0.01" wide or cracks which penetrate to reinforcement or through the member, popouts, spalling and honeycombs.

B. Classification:
   1. Structural Concrete Repair: Major defective areas in concrete members that are load carrying (such as shear walls, beams, joists and slabs), are highly stressed, and are vital to the structural integrity of the structure shall require structural repairs. Structural concrete repairs shall be made using a two-part epoxy bonder, epoxy mortar or specified polymer repair mortar. Location of structural concrete repairs shall be determined by the Engineer.
   2. Cosmetic Concrete Repair: Defective areas in concrete members that are non-load carrying and minor defective areas in load carrying concrete members shall require cosmetic concrete repair when exposed to view and not covered up by architectural finishes. Cosmetic concrete repairs may be made using a polymer repair mortar and compatible bonding agent. The location of cosmetic concrete repair required shall be determined by the Architect/Engineer. Stains and other discolorations that cannot be removed by cleaning and are exposed to view will require cosmetic repair. Cosmetic concrete repair in exposed-to-view surfaces will require Architect's approval prior to patching operations.
   3. Slab Repairs: High and low areas in concrete slabs shall be repaired by removing and replacing defective slab areas unless an alternate method, such as grinding and/or filling with self-leveling underlayment compound or repair mortar is approved by the Architect/Engineer. Repair of slab spalls and other surfaces defects shall be made using epoxy products as specified above and as determined by the Engineer. The high strength flowing repair mortar may be used for areas greater than 1 inch (25.4 mm) in depth.

3.30 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. See Testing Laboratory Services section of these Specifications for concrete materials and cast-in-place concrete inspection and test requirements.

3.31 INVESTIGATION OF LOW CONCRETE STRENGTH TEST RESULTS

A. Contractor Responsibility for Low Strength Concrete
   1. If the average of any three consecutive strength tests falls below the required f'c for a class of concrete but no individual strength test is more than 500 psi (3447.38 kPa) below f'c, the Contractor shall immediately notify the Engineer by telephone or e-mail and take immediate steps to increase the average of subsequent strength tests.
   2. If any individual strength test falls more than 500 psi (3447.38 kPa) below the required f'c, the Contractor shall immediately notify the Engineer by telephone or e-mail and take immediate steps to assure that the load-carrying capacity of the structure is not jeopardized.

B. Additional Field Tests to Conform Low Concrete Strengths
   1. The cost of all investigations of low-strength concrete, as defined by any individual strength test being more than 500 psi (3447.38 kPa) below the required f'c, shall be borne by the Contractor.
   2. Code-Prescribed Acceptance: The only accepted field-test methods of determining actual in-situ concrete strength is by the way of core tests as prescribed below.

3. Non-Destructive Tests: If any individual strength test falls more than 500 psi (3447.38 kPa) below the required f'c, the Engineer may request that non-destructive field tests be performed on the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Engineer. Report the comparative test results of the suspect concrete under consideration with identical tests done on concrete of known strength and of the same class. The Engineer considers these test results as only approximate indicators of strength and may not necessarily, by themselves, resolve the low concrete strength issue. These test results will be considered as additional information by which to make an informed judgement. The Engineer reserves the right to accept the concrete based in the results of these approximate tests or order that core tests be taken as prescribed below. At the Contractor's option, the approximate non-destructive field-tests may be waived and core tests immediately initiated.
4. Core Tests: If, in the opinion of the Engineer, the likelihood of low-strength concrete is confirmed and it has been determined that the load-carrying capacity of the structure is significantly reduced as a result, the Engineer may request that core tests be taken from the area in question as directed by the Engineer. There shall be a minimum of three cores taken for each strength test more than 500 psi (3447.38 kPa) below the required f'c and tested in accordance with ASTM C 42. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 48 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.
5. Acceptance Criteria for Core Test: Concrete in an area represented by core tests shall be considered adequate if the average of three cores is equal to at least 85% of the required f'c, and no single core is les than 75% of the required f'c. If approved by the Engineer, locations of erratic core strengths may be retested to check testing accuracy.
6. Load Test: If the concrete strength is not considered adequate based on core tests and the structural adequacy remains in doubt, the Engineer may order a load test as specified in ACI 318 be conducted for the questionable portion of the structure.
7. Strengthening of the Structure or Demolition: If the structural adequacy of the affected portion of the structure remains in doubt following the load test, the Engineer may order the structure top be strengthened by an appropriate means or demolished and rebuilt at the Contractor's expense.

END OF SECTION 03 30 00

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Concrete facing brick.
C. Clay facing brick.
D. Reinforcement and anchorage.
E. Flashings.
F. Lintels.
G. Accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2026.

PART 2 PRODUCTS

2.01 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
   1. Nominal size: As indicated on drawings.
   2. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

END OF SECTION 04 20 00

SECTION 04 72 00
CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide cast stone panels, moldings, and ornamental work, mortar, grout, reinforcement, anchorages, and accessories shown, specified, or required to complete Work.
   1. Manufacturer shall furnish Cast Stone covered by this specification.
   2. Installing contractor shall unload, store, furnish all anchors, set, patch, clean and seal the cast stone as required.

B. Contractor performing Work of this Section shall be responsible for performing unit masonry work specified in Section 04 20 00, Unit Masonry.

1.02 RELATED SECTIONS

A. Section 04 20 00, Unit Masonry

B. Section 07 90 00, Joint Sealers

1.03 REFERENCE STANDARDS

1. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.
2. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025b.
3. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.
4. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.

B. American Concrete Institute (ACI)
   1. 318, Building Code Requirements for Reinforced Concrete.

C. ASTM International ASTM
   1. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
   2. A615/A 615M, Standard Specification for Deformed and Plain Billet-Steel Bars for Reinforced Concrete.
   3. C33, Standard Specification for Concrete Aggregates.
   4. C150, Standard Specification for Portland Cement.
   5. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volume Method.
   6. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   7. C260, Standard Specification for Air-Entrained Admixtures for Concrete.
   8. C270, Standard Specification for Mortar for Unit Masonry.
   9. C494, Standard Specification for Chemical Admixtures for Concrete.
   10. C618, Specification for Coal Fly Ach and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
   11. C979, Standard Specification for Coloring Pigments for Integrally Pigmented Concrete.
   12. C989, Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete.
   13. C1194, Standard Test Method for Compressive Strength of Architectural Cast Stone.
   14. C1195, Standard Test Method for Absorption of Architectural Cast Stone.
   15. C1364, Standard Specification for Architectural Cast Stone.
   16. D2244, Standard Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

D. Cast Stone Institute
   1. Technical Manual (Current Edition)

1.04 DEFINITIONS

A. Cast Stone: A refined architectural concrete building unit manufactured to simulate natural cut stone, used in unit masonry applications.
   1. Dry Cast Concrete Products: Manufactured from zero slump concrete.
      a. Vibrant Dry Tamp (VDT) Casting Method: Vibrating ramming of earth moist, zero-slump concrete against a rigid mold until it is densely compacted.
   2. Wet Cast Concrete Products: Manufactured from measurable slump concrete.
      a. Wet Casting Method: Manufactured from measurable slump concrete and vibrated into a mold until it becomes densely consolidated.

1.05 SUBMITTALS

A. Samples: Submit minimum 6 inch (152.4 mm) long pieces of the cast stone that are representative of the general range of finish and color proposed to be furnished for the project.

B. Test Results: Submit manufacturer's test results of cast stone previously made by the manufacturer.

C. Shop Drawings: Submit manufacturers shop drawings including profiles, cross-sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors (if required), annotation of stone types and their location.

D. Engineering Calculations: Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of Texas.

E. Certification: Manufacturers affidavit that materials used in Project contains no asbestos.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Manufacturer shall have sufficient plant facilities to produce the shapes, quantities and size of Cast Stone required in accordance with the project schedule.
   2. Manufacturer shall submit a written list of projections similar in scope and at least three (3) years of age, along with owner, architect and contractor references.

B. Single Source Responsibility:
   1. Cast Stone Units: Obtain cast stone units of uniform texture and color, or a uniform blend within the accepted ranges for those characteristics, from one (1) manufacturer for each different product required for each continuous surface or visually related surfaces.
   2. For Mortar and Grout Materials: Brands of cementitious materials and admixtures, and the source of supply of sand and aggregates shall remain the same throughout the Work where exposed to view and where not scheduled to receive a subsequently applied finish, i.e. painting, etc., unless directed otherwise in writing by the Architect.
   3. Contractor's Responsibility: Contractor performing Work of this Section shall be responsible for performing unit masonry work specified in Section 04 20 00 Unit Masonry.

C. Standards: Comply with the requirements of the Cast Stone Institute Technical Manual and the project specifications. Where a conflict may occur, the contract documents shall prevail.

D. Supplementary Design Details and Engineering: The general design is presumed adequate to permit compliance with the specified performance, except the contractor is responsible to determine, furnish and install all additional blocking and bracing not shown on the drawings but required to resist wind loads and other building code requirements. Provide engineering calculations to supplement the general design bearing the seal of a Registered Professional Engineer, licensed in the State of Texas.

E. Mock-Up: Provide full size unit(s) for use in construction of sample wall. The accepted mock-up shall become the standard for appearance and workmanship for the project. The accepted mock-up may be incorporated into the finished work. Provide one half on a unit with masonry sealer as outlined in Part 2.3 of this section. The other half of the stone unit shall remain unsealed.

1.07 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 19 Project Meeting.

1.08 DELIVER AND STORAGE

A. Mark production units with the identification marks as shown on the shop drawings.

B. Package units and protect them from staining or damage during shipping and storage.

C. Stack cast stones on non-staining wood skids clear of the ground. Protect with non-staining plastic membrane or waterproof paper.

1.09 PROJECT CONDITIONS AND WARRANTY

A. Refer to Section 04 20 00, Unit Masonry.

PART 2 PRODUCTS

2.01 ACCEPTABLE

A. Manufacturers listed below or named within the specification whose product meets or exceeds the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experienced manufacturing products meeting or exceeding the specifications and comply with Division 1 regarding substitutions in order to be considered.
   1. Advance Cast Stone Inc., Fort Worth, TX; (800) 687-4352
   2. AHI, Alvin, TX; (800) 873-5794, Ext. 12
   3. Dallas Cast Stone Co., Inc., Dallas, TX; (214) 428-6269
   4. Precision Development, Inc., Houston, TX; (713) 667-1310
   5. Stone Castle Industries, Houston, TX; (713) 440-6224
   6. Any member in good standing of the Cast Stone Institute (770) 970-3011

2.02 ARCHITECTURAL CAST STONE

A. Physical properties: Provide the following:
   1. Compressive Strength: ASTM C1194: 6,500 psi (44815.94 kPa) minimum for products at 28 days.
   2. Absorption: ASTM C1195: 6 percent maximum by the cold water method or 10 percent maximum by the boiling method for products at 28 days.
   3. Air Content: ASTM C173 or C231, for wet cast product shall be 4-8 percent for units exposed to freeze-thaw environments. Air entrainment is not required for VDT products.

B. Job site testing: One (1) sample from production units may be selected at random from the field for each 500 cubic feet delivered to the job site.
   1. Three (3) field cut cube specimens from each of these samples shall have an average minimum compressive strength of not less than 85 percent with no single specimen testing less than 75 percent of design strength as allowed by ACI 318.
   2. Three (3) field cut cube specimens from each of these samples shall have an average maximum cold-water absorption of 6 percent.
   3. Field specimens shall be tested in accordance with ASTM C1194 and C1195.

C. Provide sizes and shapes as indicated on the drawings.

2.03 RAW MATERIALS

A. Portland cement: Type I or Type III, white, ASTM C150.

B. Coarse aggregates: Granite, quartz or limestone, ASTM C33, expect for gradation, and are optional for the VDT casting method.

C. Fine aggregates: Manufactured or natural sands, ASTM C33, except for gradation.

D. Colors: Inorganic iron oxide pigments, ASTM C979 except that carbon black pigments shall not be used.

E. Admixtures, comply with the following:
   1. ASTM C260 for air-entraining admixtures.

2. ASTM C494 for water reducing, retarding or accelerating admixtures.
3. ASTM C618 mineral admixtures of dark and variable colors shall not be used is surfaces intended to be exposed to view.
4. ASTM C989 granulated blast furnace slag may be used to improve physical properties. Tests are required to verify these features.

F. Water: Clean, potable

G. Reinforcing Bars:
1. ASTM A615/A615M, Galvanized or epoxy coated when cover is less than 1-1/2 inches (38 mm).
2. Welded Wire Fabric: ASTM A82 where applicable for wet cast units.

H. All anchors, dowels and other anchoring devices and shims shall be standard building stone anchors commercially available in a non-corrosive material such as zinc plated, galvanized steel, brass, or stainless steel Type 302 or 304 as specified in Section 04200 Unit Maonry.

I. Cleaner: Sure Clean No. 600 manufactured by ProSoCo Products, Inc.; or other approved by manufacturer to suit application.

J. Masonry Sealer: Breather type (non-filming forming) sealer. Advance Chemical Technology's Sil-Act 22 or General Electric Silicon PWR 255; or other approved by manufacturer to suit application.

K. Joint Mortar: Type N, ASTM C270.

L. Other Materials: Provide all other materials, not specifically described, but required for a complete and proper installation.

2.04 COLOR AND FINISH

A. Match sample on file in Architect's office.

B. All surfaces intended to be exposed to view shall have a fine-grained texture similar to natural stone, with no air voids in excess of 1/32 inch (0.79 mm) and the density of such voids shall be less than three (3) occurrences per any 1 sq inch (645.16 sq mm) and not obvious under direct daylight illumination at a 5-foot distance.

C. Units shall exhibit a texture approximately equal to the approved sample when viewed under direct daylight illumination at a 10-foot distance.
1. ASTM D2244 permissible variation in color between units of comparable age subjected to similar weathering exposure.
a. Total color difference: not greater than six (6) units.
b. Total hue difference: not greater than two (2) units.

D. Minor chips shall not be obvious under direct daylight illumination from a 20-foot distance.

E. Remove cement film, if required, from exposed surfaces prior to packaging for shipment.

2.05 MATERIAL REINFORCING

A. Manufacturer shall reinforcing the units as required for safe handling and structural stress.

B. Minimum reinforcing shall be 0.25 percent of the cross section area.

C. Panels, soffits and similar stones greater than 24 inches (609.6 mm) in one direction shall be reinforced in that direction. Units less than 24 inches in both their length and width dimension shall be non-reinforced unless otherwise specified.

D. Welded wire fabric reinforcing shall not be used in dry cast products.

2.06 MISCELLANEOUS STEEL SUB-FRAMING AND SUPPORTS

A. Provide miscellaneous steel sub-framing for cast stone pieces. The drawings indicate cast stone profiles which are to be maintained, and may indicate sub-framing, however, the quantity, location, and sizes of steel sub-framing may vary depending on the maximum size of cast stone unit that the cast stone supplier is capable of providing or that the mason is capable of installing. The quantity, location, and sizes of sub-framing required can only be ascertained by

close coordination between the cast stone suppler, the brick mason, and the supplier of miscellaneous metals. Failure to determine, and include in the proposal, the steel required for support of the cast stone shall not be considered for additional compensation, and costs related thereto shall be the responsibility of the contractor.

2.07 MATERIAL CURING

A. Cure units in a warm curing chamber approximately 100 degrees Fahrenheit (37.78 degrees Celsius) at 100 percent relative humidity for approximately 12 hours, or cure in a 100 percent moist environment at a minimum 70 degrees Fahrenheit (21.11 degrees Celsius) for 16 hours after casting. Additional yard curing at 95 percent relative humidity shall be 350 degree-days (i.e. 7 days at 50 degrees Fahrenheit (10 degrees Celsius) or 5 days at 70 degrees F) prior to shipping. Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

B. Acid etch exposed surfaces, if necessary, to remove cement film prior to packaging an shipment.

2.08 MANUFACTURING TOLERANCES

A. Cross section dimensions shall not deviate by more than ±1/8 inch (3.18 mm) from approved dimensions.

B. Length of units shall not deviate by more than length/ 360 or ±1/8 inch (3.18 mm), whichever is greater, not to exceed ±1/4 inch (6.35 mm).
   1. Maximum length of any unit shall not exceed 15 times the average thickness of such unit unless otherwise agreed by the manufacturer.

C. Warp, bow or twist of units shall not exceed length/360 or ±1/8 inch (3.18 mm), whichever is greater.

D. Location of dowel holes, anchor slots, flashing grooves, false joints and similar features: On formed sides of unit, 1/8 inch (3.18 mm), o unformed sides of unit, 3/8 inch (9.52 mm) maximum deviation.

2.09 PRODUCTION QUALITY CONTROL

A. Testing:
   1. Test compressive strength and absorption from specimens selected at random from plant production.
   2. Samples shall be taken and tested from every 500 cubic feet of product produced.
   3. Perform tests in accordance ASTM C1194 and C1195.
   4. New and existing mix designs shall be tested for strength and absorption compliance prior to producing units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Installing contractor shall check Cast Stone materials for fit and finish prior to installation. Do not set unacceptable units.

3.02 SETTING TOLERANCES

A. Comply with Cast Stone Institute Technical Manual.

B. Set stones 1/8 inch (3.18 mm) or less, within the plane of adjacent units.

C. Joints, plus – 1/16 inch (1.59 mm), minus – 1/8 inch (3.18 mm)

3.03 MORTAR MIXING

A. Thoroughly mix mortar ingredients in quantities needed in accordance with Section 04200 Unit Masonry.

B. Do not use anti-freeze compounds to lower the freezing point of mortar.

3.04 JOINTING

A. Joint size:
   1. At stone / brick joints 3/8 inch (9.52 mm)
   2. At stone / stone joints in vertical position ¼ inch
   3. Stone / stone joints exposed on top 3/8 inch (9.52 mm)

B. Joint materials:
   1. Use a full bed of mortar at all bed joints.
   2. Flush vertical joints full with mortar.
   3. Leave joints with exposed tops or under relieving angles open for sealant.
   4. Leave head joints in copings and protecting components open for sealant.

C. Location of joints:
   1. As shown on drawings and confirmed on shop drawings.
   2. At control and expansion joints unless otherwise shown.

3.05 SETTING

A. Drench units with clean water prior to setting.

B. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

C. Set units in full bed of mortar, unless otherwise detailed.

D. Rake mortar joints ¾ inch for pointing.

E. Remove excess mortar from unit faces immediately after setting.

F. Tuck point unit joints to a slight concave profile.

3.06 JOINT SEALANT

A. Comply with requirements of Section 07 90 00 Joint Sealers.

B. Prime ends of units, insert properly sized backing rod and install required sealant.

3.07 REPAIR AND CLEANING

A. Repair chips with touchup materials furnished by manufacturer.

B. Saturate units to be cleaned prior to applying an approved masonry cleaner. Consult with manufacturer for appropriate cleaners.

C. Masonry Surfaces Clean and Untreated: Examine newly laid masonry closely to ensure that its finished surface contains no releasing agents (form oil). If it does contain form oil, etch surface with muriatic acid, rinse thoroughly and/or score with a wire brush.

D. Masonry Surfaces: Remove paint, coatings, sealers and dirt by sandblasting; rinse with clear water.

3.08 INSPECTION AND ACCEPTANCE

A. Inspect finished installation according to Cast Stone Institute Technical Bulletin #36.

B. Do not field apply water repellant until repair, cleaning, inspection and acceptance is completed.

3.09 SEALER

A. Apply breather type (non-film forming) masonry sealer to completed surfaces in accordance with manufacturer's instructions. Sealer required on all exposed surfaces.

END OF SECTION 04 72 00

SECTION 05 12 13
ARCHITECTURALLY EXPOSED STRUCTURAL STEEL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to the Section.

1.02 SUMMARY

A. This Section includes requirements regarding the appearance and surface preparation of Architecturally Exposed Structural Steel. (AESS). Refer to Structural Drawings and to Division 5 for all other requirements regarding steel work not included in this section.

This section applies to any members noted on Architectural and Structural drawings as AESS 1, AESS 2, AESS 3, AESS 4 and AESS C; and in the areas defined as AESS below:

1. The following structural steel elements and connections are to be supplied and erected per AESS 1: None.
2. The following structural steel elements and connections are to be supplied and erected per AESS 2: Exposed exterior angled members supporting cantilevered 2nd floor @ Fire Station 5. Refer to drawings.
3. The following structural steel elements and connections are to be supplied and erected per AESS 3: None.
4. The following structural steel elements and connections are to be supplied and erected per AESS 4: None.
5. The following structural steel elements and connections are to be supplied and erected per AESS C: None.

B. Related Sections: The following Section contains requirements that related to this Section:

1. Division 1
   a. Section 01 22 00 “Submittal Procedures” for Fabrication Documents, Product Data, and Samples.
   b. Section 01 43 00 “Quality Assurance” for fabricator and installer qualifications independent testing agency procedures and administrative requirements.
   c. Section 01 45 00 “Quality Control” for Source and Field quality control requirements.

1.03 DEFINITIONS

A. Architecturally Exposed Structural Steel: Structural Steel conforming to one of the categories of Architecturally Proposed Structural Steel or AESS Refer to ANSI/AISC 303-16 “Code of Standard Practice for Steel Buildings and Bridges”.

B. AESS 2: Structural Steel designated as “AESS 2 inch (50.8 mm) the contract documents and conforming to ANSI/AISC 303-16, Chapter 10 definition of AESS 2. These are feature elements viewed at a distance greater than 20 feet (609.6 cm). The art of metalworking is intended to be visible to the viewer.

1.04 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022, with Errata (2025).

B. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2025).

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2026a.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

G. ASTM A1085/A1085M - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS); 2022.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

I. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

J. SSPC-SP 3 - Power Tool Cleaning; 2024.

1.05 ACTION SUBMITTALS

A. General: Submit each item below according to the Condition of the Contract and Division 1 Specification Sections.

B. Product Data for each type of product specified. Submit “Special Coatings” under Division 9.

C. Fabrication Documents: Detailing for fabrication of AESS components.
   1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.
   2. Include details that clearly identify all the requirements listed in sections 2.3 “Fabrication” and 3.3 “Erection” of this specification for each part. Provide connections for exposed AESS consistent with concepts shown on the architectural or structural drawings.
   3. Indicate welds by standard AWS symbols, distinguish between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined herein.
   4. Indicate orientation of HSS seams and mill marks (where applicable).
   5. Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections.
   6. Clearly indicate which surfaces or edges are exposed and what class of surface preparation is being used.
   7. Indicate special tolerances and erection requirements as noted on the drawings or defined herein.
   8. Indicate vent or drainage holes for HSS members.

D. Samples: Provide samples of specific AESS characteristics Samples may be shall size samples or components of conventional structural steel demonstrating the following specific AESS characteristics.
   a. Continuous weld appearance
   b. Sharp edges ground smooth
   c. Surface preparation
   d. Fabrication mark removal
   e. Weld show through

1.06 INFORMATIONAL SUBMITTALS

A. General: Submit each item below according to the Condition of the Contract and Division 1 Specification Sections.

B. Qualification data for firms and persons specified in the ‘Quality Assurance’ Submittal to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, and other information specified.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Division 5 Section ‘Structural Steel’, engage an AISC Certified Fabricator, experienced in fabricating AESS similar to that indicated for this Project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the Work.

B. Erector Qualifications: In addition to those qualifications listed in Division 5 Section ‘Structural Steel’, engage an AISC Certified Erector, experienced in erecting AESS work similar in

material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Comply with applicable provisions of the following specifications and documents:
   1. ANSI/AISC 303-16, “Code of Standard Practice for Steel Buildings and Bridges”, Section 10.

D. Pre-installation Conference: The General Contractor shall schedule and conduct conference at the project site to comply with requirements of Division 1 Section “Project Meetings”. As a minimum, the meeting shall include the General Contractor, Fabricator, Erector, the finish-painting subcontractor, and the Architect. Coordinate requirements for shipping, special handling, storage, attachment of safety cables and temporary erection bracing, final coating, touch up painting, mock up coordination, architect’s observations, and other requirements for AESS.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Delivery AESS to Project site in such quantities and at such times to ensure continuity of installation. All tie downs on loads shall be nylon straps or shall use softeners when using chains or wire rope slings to avoid damage to edges and surface of members. The standard for acceptance of delivered and erected members shall be equivalent to the standard employed at fabrication.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and package materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

C. Handle finish pieces using nylon type slings, or chains with softeners, or wipe ropes with softeners such that they are not damaged. Conform to ANSI/AISC 303-16 Sections 10.4, 10.5, and 10.6.

1.09 PROJECT CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Fabrication Documents. Coordinate fabrication schedule with construction progress to avoid delaying the work.

1.10 COORDINATION

A. Coordinate installation of anchors for AESS members that connect to the work of other trades. Furnish setting drawings, templates, and directions for installing anchors, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to the project site in time for installation. Anchorage concepts shall be as indicated on drawings and approved on final Fabrication Documents.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Meet requirements Division 5 as noted on Structural drawings and in specifications, as amended below.

B. High-Strength Bolts, Nuts, and Washers.

2.02 PAINT SYSTEM

A. Compatibility: All components/procedures of the AESS paint system shall conform to the coating system specified, submitted, and approved per Division 9. As a minimum identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating and finish coating shall be from a single manufacturer combined in a system documented by the manufacturer with adequate guidance for the fabricator to procure and execute.

B. Primer: Acrylic water-soluble shop coat with good resistance to normal atmospheric corrosion. Primer shall comply with all federal standards for VOC, lead and chromate levels.

C. Finish Coating: Field apply intermediate and top coats: Acrylics (waterborne).

2.03 FABRICATION AESS 2

A. Fabricate to Requirements of 2.03 and as follows.

B. The as-fabricated straightness tolerance shall be one-half of that specified in ASTM A6/A6M, ASTM A500/A500M, or ASTM A1085/A1085M.

C. For curved structural members, whether composed of a single standard structural shape or built-up, the as-fabricated variation from the theoretical curvature shall be equal to or less than the standard camber and sweep tolerances permitted for straight members in the applicable ASTM standard.

D. The tolerance on overall profile dimensions of welded built-up members shall one-half of that specified in AWS D1.1/D1.1M: 2015 Structural Welding Code – Steel (AWS D1.1).

E. Provide hidden part marks or piece marks that may be fully removed after erection.

2.04 SHOP PRIMING

A. Provide surface preparations to SSPC-SP 3. Coordinate the required surface profile with the approved paint submittal prior to beginning surface preparation. Prior to blasting remove any grease and oil using solvent cleaning to meet SSPC-SP 1. Weld spatter, slivers and similar surface discontinuities shall be removed. Sharp corners resulting from shearing, flame cutting or grinding shall be eased.

B. Shop prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50.8 mm).
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils 0 inch (0.04 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop primer to surfaces that are inaccessibility after assembly or erection.

2.05 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to AESS indicated for galvanizing according to ASTM A123/A123M – 2015 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products. Fabricate such that all connections of assemblies are made in the field with bolted connections where possible.

2.06 FABRICATION QUALITY CONTROL AND QUALITY ASSURANCE AESS 1 AND 2

A. Structural requirements:
   1. Conform to Quality Control requirements per ANSI/AISC 360-16 "Specification for Structural Steel Buildings" Chapter N and ANSI/AISC 303-16, "Code of Standard Practice for Steel Buildings and Bridges", Section 10. Refer to Section 05 12 00 "Structural Steel" for additional requirements.
   2. Owner will engage a Quality Assurance agency per the requirements of ANSI/ANSC 303-16 "Specification for Structural Steel Buildings" Chapter N and ANSI/ANSC 303-16, "Code of Standard Practice for Steel Buildings and Bridges", Section 10.

B. AESS acceptance: The Architect shall observe the AESS steel in the shop at a viewing distance consistent with the final installation and determine acceptability based on the qualification data and submittals. The Quality Assurance agency shall have no responsibility for enforcing the requirements of this section.

PART 3 EXECUTION

3.01 EXAMINATION

A. The erector shall check all AESS members upon delivery for twist, kinks, gouges, or other imperfection which may result in rejection of the appearance of the member. Coordinate remedial action with fabricator prior to erecting steel.

3.02 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on the approved Fabrication Documents. Temporary connections not shown shall be made at locations not exposed to view in the final structure or as approved by the Architect. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain the appearance of the AESS through the process of erection.

3.03 ERECTION AESS 2

A. Erect to the requirements of 3.3 and as follows.

B. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of ANSI/AISC 303-16.

3.04 FIELD QUALITY CONTROL AND QUALITY ASSURANCE AESS 1 AND 2

A. Structural requirements:

1. Conform to Quality Control requirements per ANSI/AISC 360-16 “Specification for Structural Steel Buildings”, Section 10. Refer to Section 05 12 00 Practice for Steel Buildings and Bridges”, Section 10. Refer to Section 05 12 00 “Structural Steel” for additional requirements.
2. Owner will engage a Quality Assurance agency per the requirements of ANSI/AISC 360-16 “Specification for Structural Steel Buildings” Chapter N and ANSI/AISC 303-16, “Code of Standard Practice for Steel Buildings and Bridges”, Section 10.

B. AESS acceptance: The Architect shall observe the AESS steel in place and determine acceptability based on the qualification data and submittals. The Quality Assurance Agency shall have no responsibility for enforcing the requirements of this section.

3.05 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint shall be completed to blend with the adjacent surfaces of AESS. Such touch up work shall be done in accordance with manufacturer’s instructions and as specified in Division 9, Section “Painting”.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded area. Any repairs to galvanized surfaces shall comply with ASTM A780/A780M – 2015 Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.

END OF SECTION 05 12 13

SECTION 05 31 00
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Composite floor deck.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete topping over metal deck.

B. Section 05 12 00 - Structural Steel Framing: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.

C. Section 05 50 00 - Metal Fabrications: Steel angle concrete stops at deck edges.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

B. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2025, with Errata (2026).

E. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
   1. Composite Floor Deck

C. Sustainable Design Submittals:

D. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.05 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.

D. Research Reports: For steel deck, from ICC-ES.

E. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

C.

D. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its RoofNav for Class 1 fore rating and Class 1-90 windstorm ratings. Identify materials with FM Approvals Certification markings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

C. Separate sheets and store deck on dry wood sleepers; slope for positive drainage. Protect with a waterproof covering and ventilate to avoid condensation.
   1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISA's "North American Specification for the Design of Cold-Formed Steel Structural Members".

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.02 COMPOSITE FLOOR DECK

A. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
   2. Profile Depth: [2] inches ([50.8] mm).
   3. Design Uncoated-Steel Thickness: [0.0474] inch ([1.2] mm).
   4. Span Condition: Triple span or more. Two span deck shall be used only where deck layout does not permit the use of three spans. Single span deck is not allowed.

2.03 ACCESSORY MATERIALS

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicted.

B. Mechanical Fasteners: Corrosion-resistance, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (227527.08 kPa), not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (227527.08 kPa) , of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Mild steel, uncoated, shaped to fit deck rib, 0.0598 inch (1.52 mm) thick, with factory-punched hole of 3/8 inch (____ mm) minimum diameter.
   1. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch (1.9 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.9 mm) thick, of same material and finish as deck, with 3-inch-wide flanges and recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

K. Galvanized Repair Paint: ASTM A780/A780M ASTM A780/A780M.

L. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work prior to beginning work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Erect metal deck and accessories in accordance with SDI Design Manual, manufacturer's instructions, SDI Publication No. 31, and requirements in this Section. Align and level.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
   1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc, welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

J. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

3.03 INSTALLATION OF FLOOR DECK

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated ad as follows:
   1. Weld Diameter: 5/8 inch (15.88 mm), nominal.
   2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inch (304.8 mm)apart, but not more than 18 inch (457.2 mm)apart.
   3. Weld Spacing: Space and locate welds as indicated.
   4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or [36] inches ([914.4] mm), and as follows:
   1. Mechanically fasten with self-drilling No. 10 diameter or larger, carbon-steel screws.

2.
3. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inch (50.8 mm), with end joints as follows:
   1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

F. Install piercing hanger tabs at 14 inch (355.6 mm)apart in both directions, within9 inch (228.6 mm)of walls at ends, and not more than 12 inch (304.8 mm) from wall at sides unless otherwise indicated.

3.04 REPAIR

A. Galvanized Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:
   1. Wire Brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
   3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 09 91 13 - Exterior Painting and Section 09 91 23 - Interior Painting.
   4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section09 91 13 - Exterior Painting and Section 09 91 23 - Interior Painting .

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.

END OF SECTION 05 31 00

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Labor, services, materials, supplies, equipment, tools, transportation, and facilities required in connection with or incidental to metal roof decking, as described in this Section, shown on Drawings, or reasonably implied therefrom, including, but not limited to:
   1. Light gauge steel framing designed to receive structural loads.
   2. C-shaped load-bearing steel studs.

1.02 REFERENCE STANDARDS

A. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2020.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

D. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process; 2025a.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

F. 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; 2022.

G. ASTM C955 - Standard Specification for Cold-Formed Steel Structural Framing Members; 2024.

H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020 (Reapproved 2024).

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

J. Metal Lath / Steel Framing Association (ML/SFA)
   1. Steel Framing Manual.

1.03 QUALITY ASSURANCE

A. Coordinate the requirements on the Structural Drawings with the requirements of this Section. If a conflict exists, notations on the Structural Drawings take precedence.

B. The following governs the Work, except where more restrictive items are specified:
   1. AISI Design of Cold-Formed Steel Formed Structural Members.

C. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedures".

D. Studs, tracks, channels, and other light gauge framing members shall conform to requirements of ASTM C955.

E. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.

1.04 SUBMITTALS

A.
   1. Manufacturer’s specification and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.

B. Shop Drawings: Provide shop drawings prepared by cold-formed metal framing manufacturer. Indicate size, material, and finish. Show locations and installation procedures along with wind load criteria (see structural drawings). Include details of joints, attachments, and clearances.

C. Supplementary Design Details: The general design is presumed adequate to permit compliance with the specified performance. Provide engineering calculations to supplement the general design. Calculations shall bear the seal of a Registered Professional Engineer, licensed in the State of Texas.

1.05 PRODUCT DELIVERY AND STORAGE

A. Protect and store metal framing and related accessories from rusting and damage in accordance to AISI's "Code of Standard Practice". Deliver to the project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry ventilated space or protect with suitable waterproof coverings.

1.06 PRE-INSTALLATION CONFERENCE

A. 01 31 00 - Project Management And Coordination

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications may be used on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions in order to be considered.
   1. Allied Studco, Inc.
   2. CLARKWESTERN Building Systems
   3. Dietrich Industries, Inc.
   4. Fire Trak Corp.
   5. Marino Ware Industries
   6. The STEEL Network, Inc.
   7. Unimast Incorporated
   8. Delta Metal Products
   9. Wheeling Corrugating Co.
   10. Nucor Building Components

2.02 MATERIALS

A. Basic Systems Components: With each type of metal framing required, provide manufacturer's standard steel top track, runner track (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for the applications indicated, as needed to provide a complete metal framing system.

B. Steel Stud System:
   1. Stud Type: C-shaped galvanized steel studs, with punched web and minimum 1-5/8 inch (41 mm) flanges with flange return lip.
   2. Guage:
      a. 12, 14, and 16 gauge formed from steel conforming to ASTM A1003/A1003M & ASTM A653/A653M, SQ, Grade 50, with 50,000 PSI minimum yield.
      b. 18 gauge formed from steel conforming to ASTM A1003/A1003M&ASTM A653/A653M, SQ, Grade 33, with 33,000 PSI minimum yield.
   3. Sizes: As indicated or required.
   4. Track, Bridging, Bracing and Misc. Items: Galvanized steel.
      a. 18 gauge formed from steel conforming toASTM A1003/A1003M & ASTM A653/A653M , SQ, Grade 33, with 33,000 PSI minimum yield, same flanges as studs, except provide Deflection Track (DT) with two (2) inch flange minimum for top of stud walls at floor or roof above, typically. Provide manufacturers standard head and by-pass clips for vertical deflection.

5. “Z” Clips: 22 gauge galvanized steel; six (6) inches long.
6. Slotted Deflection Track: Manufacturer’s single, deep-leg, U-shaped steel track: Punched with vertical slots in both legs. Steel Sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
7. Headers and Jambs: Manufacturer’s proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened.
8. Channel Bridging or Bracing: U-Channel Assembly; base metal thickness of .0538 inch (1.37 mm) and minimum ½ inch wide flanges.

C. Anchorage and Fastening:
1. Self-Drilling Self-Tapping Screws, Bolts, Nuts and Washers: Of type and size recommended by manufacturer to suit application, with hot-dip galvanized finish.
2. Anchorage Devices: Power driven or powder actuated, drilled expansion bolts; or screws with sleeves.
a. Welding: AWS D1.1/D1.1M

D. Finish
1. Galvanizing: Provide minimum G60 galvanized coating in accordance with ASTM A1003/A1003M & ASTM A653/A653M .
2. Galvanized Repair Paint: ZRC cold galvanizing compound or Galvalite manufactured by ZRC Worldwide, Marshfield, MA; Galax Zinc-rich Cold Galvanizing Coating manufactured by Alvin Products, Inc., Lawerence, MA; or paint complying with military specification MILP-21035A, Type I or II. Apply repair paint in accordance with ASTM A780/A780M .

E. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

2.03 MINIMUM DESIGN

A. Provide adequate support for the following conditions, where not detailed or noted otherwise.
1. Wind Load: As required by code officials having jurisdiction.
2. Deflection: 1/600 for clear simple spans.
3. Deflection: 1/300 for cantilever conditions and roof parapets.
4. Gauge: 18 gauge minimum, unless noted otherwise.

PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION

A. Prior to the start of installation of metal framing systems, meet at the Project site with the installers of other work including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

3.02 INSTALLATION (ERECTION)

A. Install structural members and connections in compliance with ASTM C1007.

B. General:
1. Track Anchors: Install anchors maximum 4 feet (121.92 cm) - 0 inch (0 mm) on center; design anchors and spacing to carry live, dead and wind loads.
2. Track Splices: Provide channel inserts or weld track splices.
3. Erection: Install members plumb, level, and in a true plane.
4. Fasteners: Make assemblies rigid and secure, with welds free of voids and burnouts.

C. Install metal framing systems in accordance with stud manufacturer’s printed instructions.

D. Runner Tracks:
1. Install continuous tracks sized to match studs.
2. Align tracks accurately to layout at base and tops of studs.

3. Secure tracks as recommended by stud manufacturer, except do not exceed 24 inch (609.6 mm) on center for nail or power-driven fasteners, nor 16 inch (406.4 mm) on center for other types of attachment.
4. Provide fasteners at corners and ends of tracks.
5. Tracks shall be anchored to structural steel prior to installing sprayed on insulation.
6. Provide Deflection Track (DT), at top of stud walls at floor or roof above, typically. Allow for ½ inch movement of primary structure. Do not attach studs directly to Deflection Track.
7. Vertical Deflection Clips: Provide manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure.

3.03 INSTALLATION OF STUDS

A. Secure studs to top track and bottom runner track by means of approved self-drilling screws or welding at both inside and outside flanges of 14 gauge or heavier material. Screw and welds shall be of sufficient size to insure strength of connection. All welding shall comply with American Welding Society "Specification for Welding Sheet Steel in Structures".

B. Install wall studs plumb and level except where designed as sloping members, except as needed for diagonal bracing, or required for non-plumb walls or warped surfaces and similar requirements.

C. Where stud systems abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure. Use Zee clips as specified above. Weld "Z" shaped slips to structural members as shown on drawings. Maximum 2 feet (60.96 cm) on center vertical.

D. Install supplementary framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.

E. Frame wall openings with extra studs, equal to the number of studs interrupted by wall openings, placed at each side of wall openings. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.

F. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements in accordance with manufacturer's instructions.

G. Touch-up field welds and damaged corrosion-protected surfaces zinc-rich paint in compliance with ASTM A780/A780Mexcept touch up of field cut studs is not required.

H. Frame both sides of expansion and control joints with separate studs; do not bridge the joint with component of stud system.

I. Install horizontal stiffeners in stud system, space (vertical distance) at no more than 54 inch (1371.6 mm) on center. Weld at each intersection.

END OF SECTION 05 40 00

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Provide miscellaneous metal items fabricated from heavy gage ferrous metals and not provided with structural steel system.
   1. Pre-Fabricated Steel Stair.
   2. Guard and Hand Rails.
   3. Loose Lintels.
   4. Pipe Bollard.

1.02 RELATED REQUIREMENTS

A. Other Sections in Division 5.

1.03 SUBMITTALS

A. Submit for review shop drawings, product data, and, if requested, test reports.

1.04 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Use only AWS-certified welders. Deliver, handle and store materials in accordance with manufacturer's instructions.

1.05 REFERENCE STANDARDS

A. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2024.

B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

C. Comply with relevant portions of the latest editions of applicable ASTM, ANSI, and AWS standards.

PART 2 PRODUCTS

2.01 MATERIALS

A. In fabricating items which will be exposed to view, limit materials to those which are free from surface blemishes, pitting, rolled trade names, and roughness.

B. Comply with following standards, as applicable:
   1. Steel plates, shapes, and bars: ASTM A36.
   2. Steel plates, bent or cold-formed: ASTM A283 grade C.
   3. Steel tubing, hot-formed, welded, seamless: ASTM A501.
   4. Steel bars and bar-size shapes: ASTM A306, grade 65, or ASTM A36.
   5. Cold-finished steel bars: ASTM A108.
   6. Cold-rolled carbon steel sheets: ASTM A336.
   7. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525.
   8. Stainless steel sheets: AISI type 302 or 304, 24 gage, no. 4 finish.
   9. Gray iron castings: ASTM A48, class 10.
   10. Malleable iron castings: ASTM A47.
   11. Steel pipe: ASTM A53, grade A, schedule 40, black finish unless otherwise noted.
   12. Concrete inserts:
      a. Threaded or wedge-type galvanize ferrous castings of malleable iron complying with ASTM A27.
      b. Provide required bolts, shims, and washers, hot-dip galvanize in accordance with ASTM A153.
   13. Welded wire mesh: ASTM A185.

2.02 FASTENERS

A. General:
   1. For exterior use, and in wet areas, provide zinc-coated fasteners.
   2. Provide fasteners of type, grade, and class required for the particular use.

B. Comply with following standards as applicable:
   1. Bolts and nuts: Provide hexagon-head regular type complying with ASTM A307, grade A.
   2. Lag bolts: Square-head type, Fed Spec FF-B-561
   3. Machine screws: Cadmium-plated steel type, Fed Spec FF-S-111.
   4. Washers:
      a. Plain washers: Fed Spec FF-W-92, round, carbon steel.
      b. Lock washers: Fed Spec FF-W-84, helical spring type carbon steel.
   5. Toggle bolts: Provide type, class, and style needed but complying with Fed Spec FF-B-588.
   6. Anchorage devices: Provide expansion shield complying with Fed Spec FF-S-325.

2.03 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by Contractor subject to review by Architect.

B. Hot-dip galvanize ferrous metal items at exterior and where otherwise exposed to weather.
   1. Galvanizing: ASTM A 525.
   2. Galvanizing repair paint, zinc rich primer; Tnemec, PPG, ZRC Chemical Products or equal acceptable to the Architect.

2.04 SHOP PAINT

A. Rust-inhibitive primer for ungalvanized items: Use “10-99 Tnemec Primer” or “Rustoleum Number 5769 Primer”.

B. Shop-prime all ungalvanized items except items to be embedded in concrete.

2.05 FABRICATION

A. Except as otherwise shown on the Drawings or the reviewed Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.

B. Fabricate with accurate angles and surfaces, true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hair-line joints, and using concealed fasteners wherever possible.

C. Pre-Fabricated Steel Stair: Size as indicated on plans; maintain 5’-0’ clearance at bottom of ladder to nearest wall. An engineered pre-fabricated stair system shall be designed and stamped by a Texas licensed engineer.
   1. W12x19 Stringer.
   2. Bent Tread Pan.
   3. Channel as necessary.
   4. Misc. beams as necessary.
   5. Bent Plates as necessary.

D. Railings, Toe Boards and Brackets: Comply with ANSI A 12.1, A 58.1 and Part 1910 of the Occupational Safety and Health Standards (OSHA) for railing around floor openings and exposed edges of floors, stairs, ramps, balconies and similar locations. Also, provide handrails as required by ANSI A 12.1. Installed railings and supports shall withstand a 250 lb. load applied at any point, downward or horizontally, unless specified otherwise.

E. Provide brackets and anchors for railing posts and for handrail supports, as shown and as herein specified.

F. Pipe Railings: Custom fabricate pipe railings to the dimensions and details shown, with smooth bends and welded joints ground smooth and flush. Where details are not shown use 1-1/4" steel pipe with top of top rail height as required by code.
   1. Fabricate interior pipe railings from steel pipe.
   2. Fabricate pipe railings exposed to exterior from galvanized steel pipe.
   3. Fabricate with closed ends.

G. Pipe Bollards: 6" diameter schedule 40 hot dip galvanized pipe bollards shall be installed 42" a.f.f. embedded 42" in concrete foundation. Welded ½" diameter bat rods to be set in concrete foundation. Bollard to be filled with concrete. Provide PVC bollard cover.

PART 3 EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the 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 satisfactory conditions are corrected.

3.02 COORDINATION

A. Coordinate 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 PREPARATION

A. Take field measurements prior to preparation of shop drawings and fabrication. Do not delay job; allow for on-site cutting and fitting if field measurement not practical.

3.04 INSTALLATION

A. General:
   1. Set work accurately into position, plumb, level, and free from rack.
   2. Another firmly into position.
   3. Where field welding is required, comply with AWS-recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and methods to be used in correcting welding work.
   4. Grind exposed welds smooth and touch up prime coats.
   5. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.

B. Immediately after erection, clean field welds, bolted connections, and abraded areas of priming. Paint the exposed areas with same material used for shop priming.

C. Fabrications: Provide custom fabricated metal work including the following:
   1. Structural support and bracing for operable partitions.
   2. Galvanized steel lintels at brick masonry openings.
   3. Other miscellaneous fabrications such as supports, brackets, railings, signposts, etc., as indicated on drawings.
   4. Imbedded weld plates, inserts, studs and anchors.
   5. Clip angles, brackets and corner and edge angles.
   6. Miscellaneous framing and supports.

D. Touch-up damaged coatings with shop primer and galvanizing repair paint.

E. Clean work damaged or soiled by work of this Section.

F. Finish painting is specified in Section 09 91 00 Painting.

END OF SECTION 05 50 00

SECTION 05 51 33.16
INCLINED METAL LADDERS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Fixed, inclined, aluminum, standard ship ladder with handrail.

B. Related Section:
   1. Section 06 10 00 - Rough Carpentry: Blocking in metal stud walls and partitions for anchorage of inclined ladder.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A14.3 - Ladders, Fixed, Safety Requirements.

B. American Society for Testing and Materials (ASTM) Publications:
   1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
   2. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

1.03 SUBMITTALS

A. Provide in accordance with Section 01 33 00 - Submittals Procedures.
   1. Product data for inclined ship ladd
   2. Shop drawings showing elevations, dimensions, connections, size and type of fasteners, and fabrication and installation details.
   3. Certificate showing compliance with Paragraph 1.4.
   4. Installation and maintenance inst

1.04 QUALITY ASSURANCE

A. Access ladders shall be designed and installed to comply with ANSI A14.3.

PART 2 PRODUCTS

2.01 ACCEPTABLE

A. UPNO VR, Inc., 3 Crane Way, Hooksett, New Hampshire 03106; 603-625-8639.

B. Manufacturers of equivalent products submitted and approved in accordance with Section 01 25 13 - Product Substitution Procedures.

2.02 MATERIALS

A. Extruded Aluminum: ASTM B221, Alloy 6063 Temper T-6, non-spark.

B. Sheet Aluminum: ASTM B209 6063 Temper T-6.

C. Finish: Mill finished aluminum.

2.03 GENERAL FABRICATION

A. Field verify ladder dimensions prior to fabrication.

B. Fabricate to designs indicated on Drawings and to meet performance requirements specified in Paragraph 1.4.

C. Components shall be welded and bolted. Ladder shall not require field assembly.

2.04 INCLINED SHIP LADDER

A. Type: Foldable, inclined, aluminum, standard ship ladder with handrail; Model No. U-505.

B. Accommodation Height: 12 feet 0 inches to mezzanine - referenced drawings.
   1. Preferred angle of inclination is 75 degrees. Minimum angle is 60 degrees.

C. Angle of Inclination: 90 degrees - reference drawings.

D. Treads: 6 inches wide by 1/3-4 inches deep by 24 inches wide aluminum channel shaped section with abrasive filled corrugations.

1. Equally space treads as indicated on Drawings and reviewed shop darwings.
2. Connect treads to stringers with bolts to allow for future replacement.

E. Stringers: 6 by 2 inches aluminum channel.

F. Handrail: Fabricate from 1-1/4 inches diameter aluminum pipe.
1. Form returns with 6 inches radius.
2. Attach tail to stringer with pipe sections spaced at approximately 30 inche
3. Locate bottom of handrail 36 inches above floor.
4. Extend rail above ladder such that top of rail is 42 inches above roof level.

2.05 ACCESSORIES

A. Support Brackets: Support ship ladder wiht top wall brackets and bottom floor brackets fabricated from 2 by 1/4 inch minimum flat bar aluminum.

PART 3 EXECUTION

3.01 PREPARATION

A. Prior top fabrication, field verify required dimensions.

B. Coordinate ladder instalaltion with construction of CMU walls specified in Section 04 22 00 - Concrete Unit Masonry to ensure block walls are adequately reinforced and cells grouted structrual steel mezzanine and floor framing for attachment of brackets and support of ladder.

C. Insulate dissimilar metals to prevent electrolysis with bituminous paint or non-absorptive isolation pad to prevent contact.

3.02 INSTALLATION

A. Install inclined ladder in accordance with manufacturer's instructions and reveiwed shop drawings.

B. Securely anchor support brackets with fasteners of type and size recommended by manfuactuer. Place wall brackets at top and floor brackets at bottom of ladder. Place intermediate wall brackets at 48 inches maximum.

C. Ensure ladder is plumb and rigid.

D. After installation inspect ladder to verify proper, secure, and safe installation.

E. Clean ladder using clean water mild detergent. Do not use abrasive agent, steel wool, or harsh chemicals. Rinse with clean water.

END OF SECTION 05 51 33.16

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheathing.

B. Concealed wood blocking, nailers, and supports.

C. Miscellaneous wood bracing, nailers, furring, and grounds.

1.02 REFERENCE STANDARDS

A.

B. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata (2026).

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced workers.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Framing lumber: No. 2 Douglas Fir or Southern Yellow Pine, surfaced 4 sides, 15% maximum moisture content.

B. Plywood, APA C-D exterior grade: For roof decking for metal roofing areas, and for other substrates, blocking and wall-mounted panels where required; ¾" thick.

C. Fasteners for Borate treated or Fire Treated lumber and plywood: Hot-dip galvanize nails and spikes, cadmium-plated screws and similar corrosion-resistance fasteners.

D. Pressure treated fire retarder materials: UL labeled and complying with UL FR-S Fire Hazard Classification, with a flame spread rating of 25 or less, where indicated on the drawings and where otherwise required by authorities having jurisdiction.

E. Pressure preservative treat all wood in contact with concrete, masonry, roofing, flashing, the ground, or that is subject to exposure to moisture.
   1. Pressure treat in accordance with AWPI Standard P-5, NWMA Standards, and Fed. Spec. TTW-571 with a minimum of 0.25 lb. of preservative per cubic foot; provide 0.4 lb. minimum for members in contact with the ground.

F. Sheathing: Denglass Gold water-resistant sheathing panels. Provide self-adhesive waterproofing joint tape manufactured for the purpose (not duct tape) and other necessary fasteners and accessories.

G. Fasteners for preservative treated wood:
   1. Nails: Type 316 stainless steel, ring shank.
   2. Bolts, Nuts, Washers: Under ½ inch diameter Type 316 stainless steel, ½ inch and larger hot dip galvanized. No cold galvanized or electrogalvanized material shall be used.

PART 3 EXECUTION

3.01 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. Provide studs, joists, braces, furring, nailers, blocking, grounds and plywood substate where required. Set work plumb, level, straight and true; accurately cut and aligned.

D. Install materials in accordance with manufacturer's instructions and in proper relation to adjacent construction. Coordinate with work of other sections.

E. Comply with manufacturer's requirements for cutting, handling, fastening and working treated materials.

F. Screw-apply sheathing to studs in running bond with inverted V joints to shed water. Apply self-adhesive waterproofing joint tape over all joints.

3.02 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

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 unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes, AWC (WFCM) Wood Frame Construction Manual, and _____.

E. 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.

F. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

3.04 ROOF-RELATED CARPENTRY

A. Secure all roof edge blocking in accordance with FMG 1-49 requirements. Install 50% additional fasteners at all corners.

B. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.05 PROTECTION

A. Restore damaged components. Protect work from damage.

END OF SECTION 06 10 00

SECTION 06 10 53
MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Framing with dimension lumber.
   2. Rooftop equipment bases and support curbs.
   3. Wood blocking and nailers.
   4. Wood furring and grounds.
   5. Wood sleepers.
   6. Utility shelving.
   7. Plywood backing panels.

B. Related Requirements:
   1. Section 06 16 00 “Sheathing” for sheathing, subflooring, and underlayment.
   2. Section 06 17 53 “Shop-Fabricated Wood Trusses” for wood trusses made from dimension lumber.
   3. Section 31 31 16 “Termite Control” for site application of borate treatment to wood framing.

1.02 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches (50.8 mm) nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches (50.8 mm) nominal or greater size but less than 5 inches (127 mm) nominal size in least dimension.

1.03 REFERENCE STANDARDS

A. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2026.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).

E. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

G. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2024.

H. ASTM F594 - Standard Specification for Stainless Steel Nuts; 2024.

I. AWPA M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products; 2023.

J. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.

K. ICC-ES AC58 - Acceptance Criteria for Adhesive Anchors in Cracked and Uncracked Masonry Elements; 2022.

L. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements; 2019, with Editorial Revision (2021).

M. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

N. PS 1 - Structural Plywood; 2023.

O. PS 20 - American Softwood Lumber Standard; 2025.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-department treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Suitable Design Submittals:

1.05 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
   1. Preservative-treated wood.
   2. Fire-retardant-treated wood.
   3. Power-driven fasteners.
   4. Post-installed anchors.
   5. Metal framing anchors.

1.06 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marketing for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically perform inspections to verify that the material bearing the classification marking is representative of the material tested.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
   3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat all miscellaneous carpentry unless otherwise indicated.
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches (457.2 mm) above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualifying testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (320.04 cm) beyond the centerline of the burners at any time during the test.
1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerate weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM C6841.

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contains colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.
1. Framing for raised platforms.
2. Concealed blocking.
3. Roof framing and blocking.

4. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
5. Plywood backing panels.

2.04 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: No. 2 grade of the following species:
   1. Mixed southern pine or southern pine; SPIB.

B. Other Framing: No. 2 grade of the following species:
   1. Southern pine; SPIB.
   2. Southern pine or mixed southern pine; SPIB.

2.05 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated ad lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Cants.
   5. Furring.
   6. Grounds.
   7. Utility shelving.

B. Dimension Lumber Items: No. 2 grade lumber of the following species:
   1. Mixed southern pine or southern pine; SPIB

C. Utility Shelving: Lumber with 19 percent maximum moisture content of the following species and grades:
   1. Mixed southern pine or southern pine no. 2 grade; SPIB.

D. Concealed Boards 19 percent maximum moisture content of the following species and grades:
   1. Mixed southern pine or southern pine, No. 2 grade; SPIB.

E. Of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.06 PLYWOOD BACKING

A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws or Fastening to Metal Framing: Length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fasteners systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fasteners systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC0, ICC-ES AC58, ICC-ES AC193, or ICC-ES A308 as appropriate for the substrate.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.08 METAL FRAMING ANCHORS

A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
   1. Use for interior locations unless otherwise indicated.

B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch (0.91 mm) thick.
   1. Use for wood-preservative-treated lumber and where indicated.

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
   1. Use for exterior locations and where indicated.

2.09 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.64 mm).

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Framing Standard: Comly with AF&PA's WCD 1, "Details for conventional Wood Frame Construction", unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retarant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 1 inches (25.4 mm) o.c.

G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438.4 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
   2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438.4 mm) o.c. Where fire

blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.

H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservation-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.9.1, “Fastening Schedule”, in ICC’s International Building Code.
   2. Table R602.3(1), “Fastener Schedule for Structural Members”, and Table R602.3(2), “Alternate Attachments”, in ICC’s International Residential Code for One- and Two-Family Dwellings.
   3. ICC-ES evaluation report for fastener.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.02 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.03 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring horizontally and vertically at 24 inches (609.6 mm) o.c.

3.04 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

SECTION 06 16 00
SHEATHING - USG

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall Sheathing.
B. Roof Sheathing.
C. Parapet Sheating.
D. Composite nail base insulated roof Sheathing.
E. Subflooring.
F. Underlayment.
G. Sheathing joint and penetration treatment.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry" # , Section 06 10 53 - Miscellaneous Rough Carpentry # for plywood backing panels.
B. Section 07 25 00 - Weather Barriersfor water-resistive barrier applied over wall sheathing.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Qualification Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevate temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
   4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
C. Specimen warranty.
D. Installer Qualification Data: Installer trained by a qualified trainer.
E. Product Certificates: From weather barrier manufacturer, and accessory material manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.
F. Evaluation Reports: For the following, from ICC-ES:
   1. Wood-preservative-treated plywood.
   2. Fire-retardant-treated plywood.
   3. Foam-plastic sheathing.
G. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Use materials evaluated by Air Barrier Association of America (ABAA).
B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience and approved by manufacturer.
C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of glass-mat gypsum sheathing.

D. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
   1. Build integrated mockups of exterior wall assembly 150 sq. ft. incorporating backup wall construction, window, storefront, door frame and sill, ties and other penetrations, and flashing to demonstrate crack and joint treatment and sealing of gaps, terminations, and penetrations of weather-barrier and sheathing assembly.
      a. Coordinate construction of mockups to permit inspection and testing of sheathing before external insulation and cladding are installed.
      b. Include junction with roofing membrane building corner condition, adjacent material intersection, and foundation wall intersection.
      c. If Architect determines mockups do not comply with requirements, reconstruct mockups until mockups are approved.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Testing Agency Qualifications:
   1. For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.05 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: A qualified testing agency to perform preconstruction testing on field mockups.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Delivery materials in original, unopened packaging and store products above ground in dry ventilated enclosed shelter to protect against moisture and elements. Support stacked products to prevent deformation and allow air circulation.
   1. Store within temperature limits required by manufacturer.
   2. Store sheathing board supported on risers on a flat platform.
   3. Comply with manufacturer’s written instructions for safety and handling.

C. Store panels over stable soil capable of carrying load of pallets.

D. Protect materials from soiling and damage.

E. Deliver materials to site promptly without undue exposure to weather.

F. Deliver in manufacturer’s unopened containers, pallets, or panels fully identified with name, brand, type, and grade.

G. Discard liquid materials that cannot be applied within their stated shelf life.

H. Store accessory materials in a location with constant ambient temperatures of 40 to [80] degrees Fahrenheit ([26.67] degrees Celsius).

I. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.07 FIELD CONDITIONS

A. Cold Weather Conditions:

1. Site Fluid-Applied, Vapor-Permeable Joint Flashing: Comply with manufacturer's cold weather application written instructions when atmospheric temperatures or substrate surface temperatures are less than [50] degrees Fahrenheit ([10] degrees Celsius).
2. Accessories and Sealants: Comply with manufacturer's cold weather application instructions when atmospheric temperatures or substrate surface temperatures are less than [40] degrees Fahrenheit ([4.44] degrees Celsius).

B. Exposure: Comply with manufacturer's limitations on exposure of applied product.
1. Do not apply air-barrier joint flashing to sheathing surface that is frozen or has frost.

C. Protect adjacent substrates from environmental conditions that affect air barrier performance.

D. Coordinate installation of member air barrier with completion of roofing, below-grade, factory fluid-applied membrane portion to site fluid-applied membrane portion and other work requiring interface with sheathing.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide warranty for material defects and fabrication as noted in manufacturer's documentation. Complete forms in Owner's name and register with manufacturer.

C. Manufacturer's Warranty for Sheathing Products: See manufacturer's published limited warranty:
1. Do not apply air-barrier joint flashing to sheathing surface that is frozen or has frost.

D. Protect adjacent substrates from environmental conditions that affect air barrier performance.

E. Manufacturer warranties specified in this article exclude deterioration or failure of sheathing from the following:
1. Movement of the structure caused by structural settlement or stresses on the air barrier exceeding manufacturer's written instructions for elongation.
2. Mechanical damage caused by outside agents.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested in accordance with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.02 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.03 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood unless otherwise indicated.

2.04 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated plywood materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fore-test-response characteristics specified as determined by testing identical products per test method indicating by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than [10.5] feet ([320.04] cm) beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerate weathering in accordance with ASTM D2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
   4. Design Value Adjustment Factors: Treated lumber plywood shall be tested in accordance with ASTM D5516 and design value adjustment factors shall be calculated in accordance with ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to [170] degrees Fahrenheit ([76.67] degrees Celsius) shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood unless otherwise indicating.

2.05 SHEATHING

A. Wall Sheathing
   1. Plywood Sheathing: DOC PS 1, Exterior, Structural I sheathing.
      a. Span Rating: Not less than 24/0.
      b. Nominal Thickness: Not less ½ inch
   2. Oriented-Strand-Board Sheathing: DOC PS 2 Exposure 1, Structural I sheathing.
      a. Span Rating: Not less than 16/0.
      b. Nominal Thickness: Not less than ½ inch.
   3. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide GP Gypsum; DensGlass® Sheathing or comparable product by one of the following:
         1) CertainTeed Corporation.
         2) Continental Building Products, LLC.
         3) National Gypsum Company.
         4) USG Corporation.
      b. Type and Thickness: Regular, ½ inch; Type X, [5/8] inch ([15.88] mm) thick.
      c. Size: 48 by [96] inches ([2438.4] mm) for vertical installation.
   4. Cementitious Backer Units: ASTM C1325, Type A – installed at all wet areas.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) C-Cure.
         2) Custom Building Products.

3) FinPan, Inc.
4) USG Corporation.

b. Thickness: [5/8] inch ([15.88] mm) as indicated.

5. Extruded-Polystryne-Foam Sheathing: ASTM C578, Type IV, in manufacturer's standard lengths and widths with tongue-and-groove or shiplap long edges as standard with manufacturer.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) DiversiFoam Products.
      2) Dow Chemical Company (The).
      3) Kingspan Insulation Limited.
      4) Owens Corning.
   b. Thickness: ¾ inch.
   c. Flame Propagation Test: Materials and construction shall be as tested in accordance with NFPA 285.

B. Roof Sheathing
   1. Plywood Sheathing: DOC PS 1, Exterior, Structural I sheathing.
      a. Span Rating: Not less than 48/24.
      b. Nominal Thickness: Not less than ½ inch.
   2. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural 1 sheathing.
      a. Span Rating: Not less than 48/24.
      b. Nominal Thickness: Not less than ½ inch.
   3. Fiberglass-Mat-Faced Gypsum Roof Board:
      a. Basis-of-Design Product: Subject to compliance with requirements, provide GP Gypsum: DensDeck® Prime Roof Board or comparable product by one of the following:
      b. Thickness: ½ inch thick.
      c. Size: 4 by [8] feet ([243.84] cm).
      d. Metal-Deck Flute Span: [5] inches ([127] mm).
      e. Fire-Resistance Rating: Class A in accordance with UL 790 and ASTM E108.
      f. Combustibility: Noncombustible in accordance with ASTM E136.
      g. Flame Spread and Smoke Development: Zero and zero in accordance with ASTM E84.
      h. R-value: [0.56] inch ([14.22] mm) accordance with ASTM C518.
      i. Vapor Permeance: Minimum 23 perms when tested in accordance with ASTM E96/E96M, Water Method, Procedure B.
      j. Water Absorption (Percent of Weight): 5 percent or less in accordance with ASTM C473.
      k. Surface Water Absorption: Nominal 0.035 oz. in accordance with ASTM C473.
      l. Compressive Strength: 900 lbf/sq. in. in accordance with ASTM C473.
      m. Mold Resistance: [10] inch ([254] mm) accordance with ASTM D3273.
   4. Cementitious Backer Units: ASTM C1325, Type A.
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) C-Cure.
         2) Custom Building Products.
         3) FinPan, Inc.
         4) USG Corporation.
      b. Thickness: [5/8] inch ([15.88] mm).

C. Composite Nail Base Insulated Roof Sheathing
   1. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type V with DOC PS 2, Exposure 1 oriented strand board on one face.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1) Atlas EPS; a Division of Atlas Roofing Corporation.
   2) Cornell Corporation.
   3) Dow Chemical Company (The).
   4) Hunter Panels.
   5) Johns Manville; a Berkshire Hathaway company.
   6) Rmax, Inc.
b. Polyisocyanurate-Foam Thickness: [2] inches ([50.8] mm).
c. Oriented-Strand-Board Nominal Thickness: [5/8] inch ([15.88] mm).

2. Vented, Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type II, Class 1, with DOC PS 2, Exposure 1 oriented strand board adhered to spacers on one face.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Atlas EPS; a Division of Atlas Roofing Corporation.
      2) Cornell Corporation.
      3) Dow Chemical Company (The).
      4) Hunter Panels.
      5) Johns Manville; a Berkshire Hathaway company.
      6) Rmax, Inc.
   b. Polyisocyanurate-Foam Thickness: [2] inches ([50.8] mm).
   c. Oriented-Strand-Board Nominal Thickness: [5/8] inch ([15.88] mm).
   d. Spacers: Wood furring strips or blocks not less than ¾-inch-thick and spaced not more than [16] inches ([406.4] mm) o.c.

2.06 SUBFLOORING

A. Structural cementitious subfloor panels.
   1. Size: 48 by 96 inches (1220 by 2440 mm), nominal.
   2. Thickness: 3/4 inch (19 mm), nominal.
   3. Edges: Squared along width; tongue and grooved along length.
   4. Span: 24 inches (610 mm), maximum.
   5. Fire Resistance: Noncombustible, when tested in accordance with ASTM E136.
   6. Surface Burning Characteristics: Flame spread index of 0; smoke developed index of 0; when tested in accordance with ASTM E84.
   7. Mold Resistance: Rating of 10, when tested in accordance with ASTM D3273.
   8. Density: 75 psf (3.59 kPa) in accordance with ASTM C1185.
   9. Weight: 5 psf (0.24 kPa) in accordance with ASTM D1037 at thickness of 3/4 inch (19 mm).
   10. pH Value: 10 when tested in accordance with ASTM D1293.
   11. Termite Resistance: 9.8 when tested in accordance with AWPA E1.
   12. Products:
      a. USG Corporation; Structo-Crete Brand Structural Panels.

2.07 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fasteners systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Screws for Fasteners Sheathing to Wood Framing: ASTM C1002.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Screws for fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
   1. For steel framing less than 0.0329-inch-thick, use screws that comply with ASTM C1002.
   2. For steel framing from 0.033 to 0.112-inch-thick, use screws that comply with ASTM C954.

G. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours in accordance with ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.08 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 “Joint Sealants”.

B. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
   1. Sheathing Tape: Self-adhering glass-fiber tape, minimum [2] inches ([50.8] mm) wide, 10 by 10 0r 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

C. Sheathing Tape for Foam-Plastic Sheathing: Pressure-sensitive plastic tape recommended by sheathing manufacturer for sealing joints and penetrations in sheathing.

2.09 ACCESSORIES

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Select material sizes to minimize waste.

B. Reuse and clearly separate scrap for use on-site as accessory components, including shims, bracing, and blocking.

C. Subflooring: Screw and glue to framing according to manufacturer's requirements and installation guides; staples not permitted.

D. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.

E. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.

F. Wall Sheathing with Integrated Water-Resistive Barrier and Air Barrier: Secure to studs in accordance with manufacturer's installation instructions.
   1. Install with water-resistive and air barrier on exterior side of sheathing.
   2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
   3. Do not install directly over masonry surfaces; use furring strips or framing.
   4. Apply manufacturer's standard seam sealants and transition membranes.

G. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

H. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

I. Securely attach to substrate by fastening as indicated, complying with the following:
   1. Table 2304.9.1, “Fastening Schedule”, in the ICC’s International Building Code.

J. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

K. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

L. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

M. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA E30, “Engineered Wood Construction Guide”, for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Combination Subfloor-Underlayment:
      a. Glue and nail to wood framing.
      b. Screw to cold-formed metal framing.
      c. Space panels 1/8 inch (3.18 mm)apart at edges and ends.
   2. Subflooring:
      a. Glue and nail to wood framing.
      b. Screw to cold-formed metal framing.
      c. Space panels 1/8 inch (3.18 mm)apart at edges and ends.
   3. Wall and Roof Sheathing:
      a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
      b. Screw to cold-formed metal framing.
      c. Space panels 1/8 inch (3.18 mm)apart at edges and ends.
   4. Underlayment:
      a. Nail to subflooring.
      b. Space panels1/32 inch (0.79 mm)apart at edges and ends.
      c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

3.03 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer’s written instruction.
   1. Fasten gypsum sheathing to wood framing with screws.
   2. Fasten gypsum sheathing to cold-formed metal framing with screws.
   3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   4. Install panels with a ¼-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inch (203.2 mm) o.c. and set back a minimum of 3/8 inch (9.52 mm) from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlaying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately 8 inch (203.2 mm)o.c. and set back a minimum of 3/8 inch (9.52 mm) from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlaying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Seal sheathing joints in accordance with sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

F. Fiberglass-Mat-Faced Gypsum Roof Board Installation:
1. Adhesive Installation over Thermal Insulation, under Single-Ply Roofing Systems:
   a. Stagger roof-board end- and edge-joints a minimum of 12 inch (304.8 mm) over installed insulation.
   b. Adhere roof boards over installed insulation using adhesive in accordance with roofing system manufacturer's written instructions. Apply overall pressure to ensure full adhesion. Do not slide into place.
2. Hot-Mopped Installation over Thermal Insulation, under Modified Bitumen Roofing Systems:
   a. Stagger roof-board end- and edge-joints a minimum of 6 inch (152.4 mm) over installed insulation.
   b. Prior to hot-mopping roof boards to substrates, ensure that roof boards are dry with free-moisture content less than 1 percent by weight using moisture meter set to gypsum scale.
   c. Apply asphalt only at temperatures between 425 and 450 degrees Fahrenheit (232.22 degrees Celsius).
   d. Flood Mopping: Flood mop roof boards to substrate followed by flood mopped membrane application as follows:
      1) Verify that roof boards and substrate are dry.
      2) Allow applied roof-board asphalt to cool prior to mopping membrane base sheet.
      3) Allow base ply to cool before mopping additional plies or cap sheet to limit amount of direct heat applied to boards.
3. Installation Directly on Metal Decking:
   a. Install roof boards with long edges bearing-on and parallel-to top flutes to support edges.
   b. Stagger roof-board end- and edge-joints a minimum of 6 inch (152.4 mm).
   c. Adhesive Installation: Adhere roof boards to metal deck using adhesive in accordance with roofing system manufacturer's written instructions. Apply overall pressure to ensure full adhesion. Do not slide into place.
   d. Hot-Mopped Installation:
      1) Prior to hot-mopping roof boards to substrates, ensure that roof boards are dry with free-moisture content less than 1 percent by weight using moisture meter set to gypsum scale.

2) Apply asphalt only at temperatures between 425 or 450 degrees Fahrenheit (232.22 degrees Celsius)
3) Flood Mopping: Flood mop roof boards to substrate followed by flood mopped membrane application as follows.
   (a) Verify that roof boards and substrate are dry.
   (b) Allow applied roof-board asphalt to cool prior to mopping membrane base sheet.
   (c) Allow base ply to cool before mopping additional plies or cap sheet to limit amount of direct heat applied to boards.

3.04 CEMENTITIOUS BACKER UNIT INSTALLATION

A. Install panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.05 FIBERBOARD SHEATHING INSTALLATION

A. Comply with ASTM C846 and with manufacturer's written instructions.

B. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8 inch (9.52 mm) from edges and ends.

C. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow 1/8-inch open space between edges and ends of adjacent units. Stagger horizontal joints if any.

D. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.

3.06 FOAM-PLASTIC SHEATHING INSTALLATION

A. Comply with manufacturer's written instructions.

B. Foam-Plastic Wall Sheathing: Install vapor-relief strips or equivalent for permitting escape of moisture vapor that otherwise would be trapped in stud cavity behind sheathing.

C. Apply sheathing tape to joints between foam-plastic sheathing panels and at items penetrating sheathing. Apply at upstanding flashing to overlap both flashing and sheathing.

3.07 PARTICLEBOARD UNDERLAYMENT INSTALLATION

A. Comply with CPA's recommendations for type of subfloor indicated. Fill and sand gouges, gaps, and chipped edges. Sand uneven joints flush.
   1. Fastening Method: Glue and nail underlayment to subflooring.

3.08 HARDBOARD UNDERLAYMENT INSTALLATION

A. Comply with CPA's recommendations and hardboard manufacturer's written instructions for preparing and applying hardboard underlayment.
   1. Fastening Method: Nail underlayment to subflooring.

END OF SECTION 06 16 00

SECTION 06 40 10
INTERIOR ARCHITECTURE MILLWORK

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C1036 - Standard Specification for Flat Glass; 2025.

B. BHMA A156.9 - Cabinet Hardware; 2020.

1.02 SUMMARY

A. This Section includes wood cabinets.

B. Work of this section, as shown or specified, shall be provided by the Interior Contractor and shall be in accordance with the requirements of the contract documents.

C. Submittals:
   1. Product data.
   2. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment, devices, and other components.
   3. Samples of specified wood, cut and finish. Samples shall be a minimum of 12” x 12” and full thickness. Finish face and edge shall be provided with sample.
   4. A minimum of three different flitches of any and all veneers specified shall be submitted for approval. Flitches shall indicate the color, grain, texture, and finish range to be expected in the Project.
   5. Where variations in wood and finish may occur, a minimum of three variations showing extremes which may be expected of any and all wood finishes as specified shall be submitted for approval. A minimum of 12” x 12”.
   6. Where requested, a full size mock-up of panel or millwork assembly.
   7. Samples of all mouldings shall be provided a minimum of 24” long. Sample shall indicate color, grain, and profile for approval.

D. AWI Quality Standards: Comply with “Architectural Woodwork Quality Standards” of the Architecture Woodwork Institute. Premium Grade for all materials, fabrications and workmanship for all work in this section.

E. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 PRODUCTS

2.01 MATERIALS

A. All woodwork shall be new and shall conform to the Premium Grade requirements of the AWI Quality Standards, latest edition.

B. All lumber shall be kiln-dried to the average moisture content as recommended by the AWI Quality Standards, latest edition appropriate for the regional climatic conditions of the project site.

C. All solid wood elements shall be clear, straight-grain lumber of the best grade of specified species as listed by the NHLA. Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Solid wood elements shall also be according to the following, unless indicated otherwise on drawings and/or specifications:
   1. Specie of Face Woods receiving transparent finishes shall be as specified on the drawings and shall be selected for specified grain with uniform color and grain suitable for use with the finished plywood with which it is used.
   2. Face Woods receiving opaque finishes shall be Birch, Poplar, or Custom Grade but otherwise shall have same specifications as solid stock for Face Woods above.
   3. Unexposed woods shall be Custom Grade Poplar, kiln dried unexposed woods come into contact with drawers, they shall be Birch or Maple, unselect.

D. All veneer core elements shall be clear straight-grain lumber of the best grade of the specified species as listed by the N.H.L.A. Lumber shall be free of any defects which might impair serviceability, aesthetics, and/or finish. Where veneer differs on two sides, veneers shall be of similar thickness, density, and characteristics to prevent any warpage. Veneer core elements shall also be according to the following, unless indicated on drawings or specifications:
   1. Adhesives shall be water-resistant resin or approved equal; process shall be hot plate method using the following number of plys to achieve specified thickness:
      a. ¼" 0.24 inch (6 mm) overall thickness shall be of 3-ply veneer core construction.
      b. 3/8" 0.35 inch (9 mm) overall thickness shall be of 5-ply veneer core construction.
      c. ½" 0.47 inch (12 mm) overall thickness shall be of 5-ply veneer core construction.
      d. ¾" 0.79 inch (20 mm) overall thickness shall be of 7-ply veneer core construction.
      e. 1" 0.98 inch (25 mm) overall thickness shall be of 9-ply veneer core construction.
   2. Where burl panels are specified core must be crossbanded with Poplar prior to applying burl veneer.
   3. Provide Douglas or Poplar Fir V-type solid edge trim on all exposed edges of plywood not designated to be surfaced by plastic laminate.
   4. For Face Woods receiving transparent finishes, Species shall be as specified on drawings; faces shall be selected and approved in respect to cutting lengths, uniformity of color, figure, and grain character. Face veneers shall not contain open joints, face depressions, glue stain or other manufacturing irregularities.
   5. Face Woods receiving opaque finishes shall have custom grade (face veneer) Birch or Poplar, selected, but otherwise shall have same specification as Plywood for Face Woods.
   6. Unexpected woods shall be Birch, Poplar or Douglas Fir, rotary cut, Unselect, good one side, interior type plywood, one side Grade A and one side Grade B; Grade A faces shall not contain plugs, knots, pitch pockets, splits, rough grain or other open defects.
   7. Wood for plastic lamination shall be minimum ¾" 0.79 inch (20 mm) Mahogany face core plywood, good one side.

E. All particle board be resin impregnated wood flakes of high density construction as manufactured by U.S. Plywood Corporation, Shasta Division, Redding, California, or approved equal and shall be ¾" 0.79 inch (20 mm) minimum thickness, unless otherwise specified.
   1. For Unexpected Woods: High density particle board may not be substituted for plywood panels.

F. All masonite shall be 1/8" 0.12 inch (3 mm) thick tempered, as manufactured by Masonite Corporation, Chicago, Illinois, or an approved equal.

G. All panelwork materials shall be as indicated on drawings and specifications constructed of ¾" 0.79 inch (20 mm) plywood with finish veneer front side, and veneer of similar thickness, density and characteristics back side, and hardwood edges. Finish veneer and hardwood edges shall be of species indicate on drawings and specifications using the type of veneer cut and type of match between individual veneer pieces as indicated.

H. All Millwork shall be finished as indicated on drawings and specifications. Transparent and Opaque Finishes shall match approved samples submitted. All plastic laminate finishes shall be of the quality, color and finish as indicated on the drawings and specifications.

I. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware".

J. Clear Float Glass for Doors: ASTM C1036, Type I, Class 1, Quality q3, 0.24 inch (6 mm) thick, unless otherwise indicated.

K. Furring, Blocking, Shins, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

2.02 FINISHES

A. All millwork shall be finished in accordance with the drawings, specifications and the quality levels indicated in this section.

B. All finishes shall be in compliance with all Code and Regulatory Agency requirements for the Project and location within the Project.

C. All finish materials shall be treated with flame-retardant process where required by local code. Should flame-retardant process cause change in color and effect on finish materials, Contractor shall notify the Architect prior.

D. Prior to finishing woods shall be filled, sanded primed, and cleaned. When necessary for an even final finish color beach woods prior to filling and sanding.

E. Transparent finishes on wood shall be full filled, stained to match the color required, and have a water, alcohol, and burn resistant finish, the degree of sheen to match the sample provided/approved.

F. All paint and other finish material shall be pure, unadulterated and best quality from specified manufacturer as indicated on the drawings and specifications.

2.03 FABRICATION

A. General: Complete fabrication, including assembly and finishing, before shipment to Project site to maximum extent possible. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Assemble casing in plant except where limitations of access to place of installation require field assembly.
   2. Shop-cut openings, to maximum extent possible. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.
   3. Install glass to comply with FGMA “Glazing Manual”. For glass in wood frames, secure glass with removable stops.
   4. Fabricate all items with one inch long 45 degree corners.

B. Stained Wood cabinets: As follows:
   1. AWI Grade: Custom.
   2. AWI Type of Cabinet Construction: As indicated.
   3. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
      a. Provide Architect’s selections from stain manufacturer’s full range of colors and finishes.
   4. Colors, Patterns, and Finishes: Provide stain colors complying with the following:
      a. Provide Architect’s selections from stain manufacturer’s full range of colors and finishes.
   5. Provide dust panels of ¼-inch 0.25 inch (6.4 mm) plywood above compartments and drawers except where located directly under tops.

C. Countertops: As follows:
   1. Provide solid surface counter tops with integral backsplashes – full length of top, undermounted with stainless steel sinks, refer to plumbing schedules, all properly braced and supported U.N.O.
      a. Gibraltar with standard ‘Setback’ counter top edge condition. For sinks sizes as indicated. Sinks shall be ADA compliant.
      b. Final finish colors will be selected by Architect at a later date from manufacturer’s full range.

D. Shelving:
   1. Fabricate shelves spanning more than 30 inches (762 mm) between supports of full 1 inch (25.4 mm) thick stock.

PART 3 EXECUTION

3.01 INSTALLATION

A. Preparation: Condition woodwork to average prevailing humidity conditions in installation areas, and examine and complete work as required, including back priming and removal of packing, before installing.

B. Install woodwork to comply with AWI Section 1700 for the same grade specified above for type of woodwork involved.
   1. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch (3.18 mm) in 96 inches (2438.4 mm).
   2. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damage finish at cuts.

C. Tops: Anchor securely to base units. Seal space between backsplash and wall.

D. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets.
   1. Exposed Hardware Finishes: Provide satin stainless steel or aluminum finish.
   2. For concealed hardware provide manufacturer's standard finish that complies with product class requirements of BHMA A156.9.
   3. Provide soft-close hinges for 180 degree opening.
   4. Drawer glides: Provide full extension; soft-close ball bearing, side mounted units with 75-pound load capacity; finish zinc.
   5. Door and Drawer Pulls: 4-1/2 inch (114 mm) long aluminum square bar pulls.
   6. Locks: Five pin tumbler dead bolt.

END OF SECTION 06 40 10

SECTION 06 41 16
PLASTIC LAMINATE CLAD ARCHITECTURE CASEWORK

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI A208.1 - American National Standard for Particleboard; 2022.

C. BHMA A156.9 - Cabinet Hardware; 2020.

1.02 SUMMARY

A. Section Includes:
   1. Provide plastic laminate faced wood casework and related countertops, scribe strips, filler panels, and special construction for casework where noted on Drawings.
   2. Provide locks for casework doors and drawers where noted.
   3. Provide boxes and conduit for electrical power and communications systems within casework where noted.
      a. Coordinate sizes and installation locations of items to be installed within casework with Electrical Drawings and with Project Electrical Contractor.
      b. Provide a pull wire within conduit installed in casework for use by Electrical Contractor for installing wiring.

B. Work By Other Contractors:
   1. Electrical:
      a. Electrical Contractor shall provide wiring within conduit which has been built into casework under this Section, make connections to electrical power and communications systems and complete installation of receptacles and other electrical items within casework.

1.03 SYSTEM DESCRIPTION

A. General Requirements:
   1. ADA Requirements: The following special requirements shall be met, where specifically indicated on Drawings as “ADA”, or indicated by a General Note. To be in compliance with ADA Standards and Regulations:
      a. Countertop Height: With or without cabinet below, not to exceed a height of 34” above finished floor, at a surface depth of 24”.
      b. Kneespace Clearance: Not less than 27” above finished floor, and 30” clear span width.
      c. 12” deep shelving, adjustable or fixed: Not to exceed a range from 9” above finish floor to 54” above finish floor.
      d. Wardrobe Cabinets: to be furnished with rod/shelf adjustable to 48” above finish floor, at a maximum 21” shelf depth.

1.04 SUBMITTALS

A. General Requirements: Provide submittals in accordance with Section 01 33 00.

B. Shop Drawings:
   1. Show layout of casework provided under this Section, including plans, elevations, cross-sections, and details.
   2. Identify types and location of anchors.
   3. Provide details of cabinet construction which clearly identify compliance with these Specifications and Drawings.
   4. Show layout of casework with relation to surrounding walls, doors, windows, and other building components.
   5. Coordinate shop drawings with other related work.

6. Indicate utility service run spaces/provisions, and locations of access panels for utility services as required and as coordinated with each utility service installer.

C. Product Date: Submit Product Data on hardware and complete specifications on materials used.

D. Samples:
1. Prior to commencing fabrication of casework, submit a sample of a base cabinet.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with not less than 10 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Protect casework in transit.

B. Delivery: Deliver casework only after wet (moisture producing) operations in building are completed and the required environmental conditions are as specified under this Section.

C. Storage and Protection:
1. Store casework under cover in a ventilated building not exposed to extreme temperature and humidity changes.
2. Do not install casework in building until wet operations have been completed and dry conditions exist with relative humidity not exceeding 50 percent.

D. Protection:
1. Protect finished surfaces from soiling and damage during handling and installation.
2. Keep covered with a protective covering.

1.07 SITE CONDITIONS

A. Environmental Requirements: Not less than 24 hours before, during, and continuously after installation of work of this Section, maintain the same temperature and humidity conditions in building installation areas as will occur after occupancy by Owner.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before enclosed and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets area indicated to fit to other construction, established dimensions for areas where cabinets are to fit. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 PRODUCTS

2.01 CASEWORK AND COUNTERTOP MATERIALS

A. Laminate Plastics/Finishes:
1. Acceptable Manufacturers: Subject to compliance with requirements of the Contract Documents, acceptable manufacturers are as follows or Owners approved equal:
a. Wilsonart International, Inc.
b. Formica Corporation.
c. Nevamar Corporation.
2. Selection: Architect will select colors, patterns, and finish textures or plastic laminate.
3. Horizontal General Purpose Grade: High pressure decorative type plastic laminate in accordance with requirements of NEMA Standards GP50, Publication LD3-1980.
4. Vertical General Purpose Grade: High pressure decorative type plastic laminate in accordance with requirements of NEMA Standards GP28, Publication LD3-1980.

5. Horizontal Post-Forming Grade: High pressure decorative type plastic laminate in accordance with requirements of NEMA Standards PF42, Publication LD3-1980.
6. Cabinet Liner: High pressure cabinet liner type plastic laminate in accordance with requirements of NEMA Standards CL20, Publication LD3-1980.
7. Backing Sheet: High pressure backing sheet type plastic laminate in accordance with requirements of NEMA Standards BK20, Publication LD3-1980.

B. Particleboard: 47-pound density, formaldehyde free resin composition board engineered to meet requirements of ANSI A208.1, Grade M-3.

C. Pressure Fused Melamine Surfaced Particleboard:
1. Melamine pressure fused to 47-pound density particleboard. Particleboard to be a balanced construction with a maximum moisture content of 8 percent.
2. Particleboard to meet requirements with ANSI A208.1-1993.

D. Polyester Laminate Particleboard:
1. Thermosetting polyester resin impregnated overlay bonded to 45-pound density particleboard.
2. Particleboard to be a balanced construction with a maximum moisture content of 8 percent.
3. Particleboard to meet Commercial Standard CS236-66.
4. Polyester laminate to be 9 to 11 mils (0.2794 mm) in thickness, 62 percent resin content, colorfast, and shall meet or exceed NEMA Test LSI-2.06.

E. PVC Edge Band:
1. Provide 0.04 inch (1 mm) and 0.12 inch (3 mm) thickness where specified.
2. PVC edging to be solid, high impact, purified, color-through, and acid resistant.
3. Machine apply edging with hot melt adhesive.
4. Radius exposed edges of edge banding for uniform appearance.
5. Radius outside corners of edge banding.
6. Architect will select colors from edge banding manufacturer's standard colors.

F. Casework Hardware:
1. Hinges: Heavy duty, 5-knuckle, 2 ¾" institution type hinge shall meet ANSI/BHMA A156.9 Grade 1 requirements. Mill ground, hospital tip, tight pin feature with all edges eased. Hinge to be full wrap around type of tempered steel 0.095" thick. Each hinge to have minimum (9) screws, No. 7, 5/8" FHMS to assure positive door attachment. Hinge to accommodate 13/6" thick laminated door and allow 270 degree swing.
   a. Hinge Quantity: (2) for doors up to 48" high; (3) for doors over 48" high.
   b. Hinge Finish: Satin Chrome Finish.
2. Pulls: Stanley, Model 34-5840-4477 US26D, 3-1/2" or Owner approved equal.
3. Drawer Slide:
   a. Standard Box Drawer Slides: Slides to be full extension type with self-closing design. White epoxy powder coated with positive in-stop, out-stop, and out-keeper to maintain drawer in 80 percent open position. Captive nylon rollers, front and rear. Minimum 100-pound dynamic load rating at 50,000 cycles. Minimum 150-pound static load rating. Provide a lifetime warranty from the slide manufacturer.
   b. File Drawer Slides: Full extension, 3-part progressive opening slide, minimum 100-pound, zinc plated or epoxy coated at manufacturer's option.
   c. Paper Storage Drawer Slides: Full extension, 3-part progressive opening slide, minimum 100-pound, zinc plated or epoxy coated at manufacturer's option.
4. Catches: Magnetic type. Ives, No. 323A69, Aluminum-Bronze, metal finish, or Owner approved equal.
5. Elbow Catches:
   a. Acceptable Manufacturers: Subject to compliance with requirements of the Contract Documents, acceptable manufacturers are as follows:
      1) H.B. Ives Company, No. 2 Elbow Catch.

b. Provide 1 elbow catch for inactive leaf of each locked pair of casework doors.

6. Locks: Provide locks on doors and drawers where noted on Drawings, which comply with following requirements:
   a. Disc tumbler cylinder cam type locks for overlay cabinet construction.
   b. Separately keyed locks shall have (2) keys.
   c. Provide master keys as directed.
   d. Locks shall engage metal strike plate.
   e. Locks shall permit withdrawal of keys without locking.
7. Adjustable Shelf Supports:
   a. Injection molded polycarbonate, clear color to blend with selected interior finish, friction fit into cabinet end panels and vertical dividers, readily adjustable on 1.26 inch (32 mm) centers.
   b. Each shelf support to have (2) 2” integral support pins, 0.2 inch (5 mm) diameter, to interface predrilled holes, and to prevent accidental rotation of support.
      1) Provide supports that are designed to readily permit field fixing of shelf if desired.
   c. Provide non-tip feature for shelving.
8. Wardrobe Rod: 1 1/16” diameter, chrome plated steel rod supported by appropriate flanges.
9. Coat Hooks:
   a. Single Coat Hooks, Wall Mounted: Aluminum with satin finish.
   b. Double Coat Hooks, Wall Mounted: Aluminum with satin finish.
10. Grommets: ABS plastic with cap. Black finish.

2.02 FABRICATION OF CABINETS

A. General Requirements: Agri-board may be used where particleboard is specified within this Section.
   1. Particleboard cabinet components to be of the following minimum core thicknesses prior to application of plastic laminate surfacing.
      a. 3/8”: Concealed cabinet backs; drawer bottoms.
      b. ½”: Drawer sides and backs. Drawer under-bottom stiffners.
      c. 5/8”: Drawer subfronts.
      d. ¾”: Base and tall cabinet tops and bottoms; cabinet sides, which are not exposed at completion of installation; shelving up to 30” wide located behind solid cabinet doors; drawer spreaders; doors; drawer fronts; cabinet back rear hangstrips; dividers; exposed cabinet backs.
      e. 1”: Wall cabinet tops and bottoms; shelving 30” wide and over located behind solid cabinet doors; all widths of exposed cabinet shelving.

B. Cabinet Design:
   1. Flush overlay design with radius on corners of drawers and doors.
   2. Factory fabricate laminate faced casework to dimensions, profiles, and details noted on drawings.

C. Fabrication of Sub-Base: Project site fabricated as specified under Part 3 of this Section.

D. Cabinet Joinery:
   1. Join cabinet tops and bottoms to ends using not less than (6) dowels at each joint for 24” deep cabinets and not less than (4) dowels at each joint for 12” deep cabinets.
   2. Dowels to be industrial grade hardwood laterally fluted, with chamfered ends and not less than a 0.39 inch (10 mm) diameter.
   3. Dowel in place internal cabinet components, including fixed horizontals, rails, and verticals.
   4. Securely glue dowels and clamp cabinets under pressure during assembly to assure secure joints and cabinet squareness.

E. Fabrication of Casework Cabinets With Closed Interiors:
   1. Exposed cabinets sides to be ¾" thick particleboard laminated on exterior with high pressure decorative laminate GP28 and balanced with high pressure cabinet liner CL20. Cover front edges with 0.12 inch (3 mm) PVC edge banding.
   2. Concealed cabinet sides to be ¾" thick particleboard laminated both sides with pressure fused melamine in neutral color. Cover front edges with 0.12 inch (3 mm) PVC edge banding.
   3. Unit top or subtop to be ¾" thick particleboard laminate both sides with pressure fused melamine. Cover front edge with 0.12 inch (3 mm) PVC edge banding. Subtops to be full depth. Sink base units to have a ¾" front and rear stretcher in lieu of full subtop. Depth of stretcher varies with sink size and location.
   4. Bottom of base and wardrobe cabinets to be ¾" thick particleboard laminated both sides with pressure fused melamine. Cover front edge with 0.12 inch (3 mm) PVC edge banning.
      a. Cover both sides of sink cabinet bottoms with CL20 plastic laminate.
   5. Fixed intermediates to be ¾" thick particleboard laminated both sides with melamine. Cover front edge with 0.12 inch (3 mm) PVC edge banding. Provide intermediate on units over 36" wide.
   6. Cabinet Backs:
      a. Concealed Cabinet Unit Backs: 3/8" thick particleboard with pressure fused melamine on both sides in neutral color. Cabinet backs to be fully housed into sides, top, and bottom and recessed 7/8" from cabinet rear.
      b. Exposed Cabinet Unit Backs and Exposed Ends: ¾" thick particleboard laminated with CL20 on interior to match melamine color and GP28 on exterior as selected by Architect.
      c. Attach cabinet backs using waterproof hot melt adhesive.
   7. Cabinet Interiors Behind Doors: Pressure fused white melamine laminate or high pressure balancing sheet (cabinet liner – CL20) on cabinet sides, back and bottom and under side of subtop.
   8. Fixed and adjustable Shelves in Enclosed Cabinets: Shelves concealed behind solid doors.
      a. Shelf Core and Surface Material: Either polyester laminate on both sides of particleboard core or particleboard core with a high pressure plastic laminate balancing sheet (cabinet liner – CL20) on both sides.
      b. Shelf Thickness: ¾" for shelves in cabinets up to 30" wide; 1" for shelves in cabinets 30" and more wide.
      c. Shelf Edging: Cover front and back edges of shelves with 0.04 inch (1 mm) PVC, in color selected by Architect, cover side edges with plastic laminate in color/pattern selected by Architect.

F. Fabrication of Casework Cabinets With Open Interiors:
   1. Exposed sides/ends of an open cabinet to be ¾" thick particleboard laminated both sides with high pressure decorative laminate GP28. Cover front edge with 0.12 inch (3 mm) PVC edge banding.
   2. Concealed sides of an open cabinet (adjacent to a wall, enclosed cabinet, or similar condition) to be ¾" thick particleboard laminated on interior with high pressure decorative laminate GP28 and balanced with high pressure backer BK20. Cover front edge with 0.12 inch (3 mm) PVC edge banding.
   3. Unit top or subtop to be ¾" thick particleboard laminated with GP28 and balanced with high pressure backer BK20. Cover front edge with 0.04 inch (1 mm) PVC edge banding. Substops to be full depth and width of cabinet.
   4. Bottom of base to be ¾" thick particleboard laminated on interior with high pressure decorative laminate GP28 and balanced with high pressure backer BK20. Cover front edge with 0.12 inch (3 mm) PVC edge banding.

5. Fixed intermediates to be ¾" thick particleboard laminated both sides with high pressure decorative laminate GP28. Cover front edge with 0.12 inch (3 mm) PVC edge banding. Provide an intermediate on units over 36" wide.
6. Exposed back on fixed or moveable cabinet to be ¾" thick particleboard laminated both sides with high pressure decorative laminate GP28.
7. Interiors in Open Cabinets: Vertical general purpose grade (GP28) high pressure plastic laminate on cabinet sides, back, and bottom. Colors shall match cabinet exteriors.
8. Fixed and Adjustable Shelves in Open Cabinets or Behind Glass Doors:
   a. Shelf Core and Surface Material: Particleboard core with vertical general purpose grade (GP28) plastic laminate both sides.
   b. Shelf Thickness: 1" for all cabinet widths.
   c. Shelf Edging: Cover all edges with 0.04 inch (1 mm) PVC edging, or vertical general purpose grade (GP28) plastic laminate, in color to match color of plastic laminate on face of shelves.

G. Wall Unit Bottom:
1. Units with open interiors shall be 1" thick particleboard laminated with high pressure decorative laminate GP28 on the inside, color as selected. Laminate outside with CL20, neutral color to match adjacent unit bottom.
2. Units with closed interiors to be ¾" thick particleboard laminated both sides with pressure fused melamine laminate in neutral color.
3. Cover front edge with 0.12 inch (3 mm) PVC edge banding.
4. Cover exposed bottom edge of each wall cabinet side with 0.12 inch (3 mm) PVC edge banding.

H. Wall and Tall Unit Tops:
1. Cover top edge of wall and tall unit end panels with 0.12 inch (3 mm) PVC edge banding.
2. Raw edges at top of wall and tall unit end panels is not permitted.
3. Top to be 1" thick particleboard laminated with pressure fused melamine in neutral color to match interior color.

I. Door and Drawer Fronts:
1. Fronts shall be not less than ¾" thick particleboard core with GP28 plastic laminate adhesively bonded to exterior surface and CL20 plastic laminate balancing sheet adhesively bonded on interior surface. Cover edges with 0.12 inch (3 mm) PVC edge banding.
2. Provided double doors on cabinets which are in excess of 24" in width.
3. Clearance between doors and drawers to be 1/8".

J. Drawer Construction:
1. Drawer fronts to be applied to drawer sub-front.
2. Drawer bodies, including sides, back, and sub-front to be ½" thick particleboard, laminated with pressure fused melamine in neutral color.
   a. Painted finish on drawer sides will not be permitted.
3. Provide dadoed construction with hot melt glue at corner joints between drawer sides and drawer back and sub-front.
4. Drawer bottoms to be not less than 3/8" pressure fused particleboard in neutral color, housed and glued, into front, sides, and back.
   a. Painted finish on drawer bottom will not be permitted.
5. Reinforced drawer bottoms with intermediate spreaders.
6. Cover exposed top edges of drawer members with 0.12 inch (3 mm) PVC edge banding.
7. Construct paper storage drawers the same as specified for typical drawers with the additional of a paper retaining hood continuous across rear of the drawer.

K. Access Panels: Provide access panels in casework where required for access to Mechanical and Electrical work to be installed within the casework. Access panels shall be not less than 12" be 12" and hinged. Provide access panels at cleanouts, valves, junction boxes, and at other

mechanical and electrical components as required. Verify field conditions and coordinate quantity, sizes, and locations of access panels with Mechanical and Electrical Contractors.

1. Review with and obtain approval of Architect for sizes, locations, and installation methods of access panels.

2.03 FABRICATION OF PLASTIC LAMINATE COUNTERTOPS

A. Core: Particleboard, ¾" thick if applied directly to a base cabinet, 1 ¼" thick where countertops spans an open space between base cabinets and where countertop overhangs base cabinet by more than 2". Provide 1 ½" thickness at exposed faces/edges of countertop.

B. Countertop Faces/Edges:
   1. 0.12 inch (3 mm) thick PVC edge.
   2. 0.12 inch (3 mm) thick PVC edge, except where countertop is indicated to be self-edged using post-formed type plastic laminate forming a rounded edge/corner between horizontal and vertical surfaces.
   3. Post-formed with raised waterfall edge.

C. Finish:
   1. Cover countertops with a PF42 Grade plastic laminate.
   2. Adhere plastic laminate to core by hot-press method.
   3. Provide BK20 balancing backer sheet on underside of countertops for balanced construction.

PART 3 EXECUTION

3.01 PREPARATION

A. Conditioning: Condition casework to average prevailing humidity conditions in installation area before installing.

B. Examination: Before installing casework, examine shop fabricated work for completion and complete work as required, including removal of packing.

3.02 INSTALLATION

A. General Requirements:
   1. Refer to Part 2 of this Section for additional information regarding installation of specified products.

B. Workmanship:
   1. Install casework straight, level and plumb and securely anchor in place. Scribe and closely fit to adjacent work. Cut and fit work around pipes, ducts, and other penetrating and adjacent items.
   2. Install all items complete and adjust all moving parts to operate properly.
   3. Leave surface clean and free from defects at time of final acceptance.

C. Cabinet Sub-Bases:
   1. Provide site constructed sub-base for support of floor mounted type cabinets.
   2. Construct sub-bases that are separate from cabinets and run continuous under banks of cabinets.
   3. Do not extend individual cabinet body sides-to-floor, unless otherwise indicated or approved for a specific cabinet design.
   4. Provide ladder-type platform design sub-bases, which consist of front, back, and intermediate front to back connecting members.
   5. Use water resistant exterior grade type plywood for sub-base members.
   6. Construct sub-bases to conform to floor and wall conditions and to form secure and level platforms for supporting cabinets.
   7. Securely attach sub-bases to floor substrate using concealed fasteners.
   8. Securely attach cabinets to sub-bases using concealed fasteners.
   9. Exposed surfaces of sub-bases will be covered with resilient base by others.

3.03 ADJUSTING

A. General Requirements: Repair damage and defective woodwork where possible to eliminate defects functionally and visually; where not possible to repair, remove woodwork and install new. Adjust joinery for uniform appearance.

3.04 CLEANING

A. General Requirements: Remove cartons and debris, leave interior spaces clean and casework ready for Owner's use.

3.05 PROTECTION

A. General Requirements: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensure that casework is being without damage or deterioration at time of Substantial Completions.

END OF SECTION 06 41 16

SECTION 07 11 13
BITUMINOUS DAMPPROOFING

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. Cold-applied, emulsified-asphalt dampproofing.
   2. Protection course.

B. Apply dampproofing to surfaces indicated, including:
   1. Concrete foundation walls.
   2. Other locations indicated on drawings.

C. Related Requirements:
   1. Section 071326 “Self-Adhering Sheet Waterproofing” for waterproofing.

1.03 FIELD CONDITIONS

A. Product Data: For each type of product.

1.04 ACTION SUBMITTALS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers’ written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide protection course, molded-sheet drainage panels and auxiliary materials recommended in writing by manufacturer of primary materials.

B. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise required.

C. Application Method: Based on substrate, use dampproofing designed for the following application method:
   1. For cast-in-place concrete substrates: Use roller, brush, or trowel, per manufacturer recommendations.
   2. For concrete unit masonry: Use trowel.

2.02 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may ne incorporated into the Work include, but are not limited to, the following:
   1. BASF Construction Chemicals – Building Systems; Sonneborn Brand Products; Hydrocide 700.
   2. Henry Company; 789 Fibered Asphalt Emulsion Dampproofing.
   3. Karnak Corporation; No. 220 Emulsion Asbestos Free.
   4. Meadows, W.R., Inc.; Sealmastic Emulsion.

B. Trowel Coats: ASTM D 1227, Type II, Class 1, fibered.

C. Fibered Brush and Roller Coats: ASTM D 1227, Type II, Class 1.

2.03 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Primer: As recommended in writing by manufacturer of dampproofing to be applied.

C. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

D. Patching Compound: Epoxy or latex-modified repair mortar or Asbestos-free fibered mastic of type recommended in writing by dampproofing manufacturer.

2.04 PROTECTION COURSE

A. Protection Course: As recommended by dampproofing manufacturer to suit project conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substates, areas, and conditions with Applicator present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of bituminous dampproofing work.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B. Clean substrates of projections and substrates detrimental to the dampproofing work; fill voids, seal joints, and remove bond breakers if any, as recommended in writing by prime material manufacturer.

C. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections; cover with asphalt-coated glass fabric where required by manufacturer.

3.03 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of Dampproofing.
   1. Apply primer to all substrates.
   2. Apply first coat of Dampproofing over primer.
   3. Embed fabric reinforcement into first ply of Dampproofing.
   4. Apply second coat of Dampproofing to required thickness.
   5. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
   6. Allow each coat of Dampproofing to cure per manufacturers written instruction before applying subsequent coats.
   7. Allow Dampproofing to cure prior to backfilling.

B. Where dampproofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches (152.4 mm) over outside face of footings.
   1. Extend dampproofing 12 inches (304.8 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
   2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced", by embedding an 8-inch- wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

3.04 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing-material and protection-course manufacturers' written instructions for attaching protection course.
   1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
   2. Install protection course after installation of dampproofing (while coating is tacky) to ensure adhesion and as recommended by the dampproofing manufacturer.

3.05 CLEANING

A. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 11 13

SECTION 07 13 26
ADHERING SHEET MEMBRANE WATERPROOFING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.

C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2025).

D. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008 (Reapproved 2023).

E. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

F. ASTM D4263 - Standard Practice for Indicating Moisture in Concrete by the Plastic Sheet Method; 2024.

1.02 SUMMARY

A. Scope:
   1. Apply waterproofing to:
      a. Exterior of walls below grade:
         1) Waterproofing shall include exterior of walls surrounding elevator pits and sumps.
         2) If not otherwise indicated, cover top of footing projections at below grade terminations.
      b. Underside of all basement structural slabs.
         1) Waterproofing shall include underside of elevator foundation cap and sumps.
      c. Top side of below-grade slab over basement.
      d. Other areas indicated.

B. Related documents
   1. Section 03 30 00 CAST-IN-PLACE CONCRETE

1.03 QUALITY ASSURANCE

A. ASTM Standards:
   1. ASTM C836: Crack cycling.
   2. ASTM D412: Tensile strength and ultimate elongation.
   3. ASTM D570: Water absorption.
   4. ASTM D4258: Surface cleaning of concrete.
   5. ASTM D4263: Test for capillary moisture.
   6. ASTM E154: Puncture resistance.
   7. ASTM D1876: Peel Resistance of Adhesives.
   8. ASTM D903: Peel Adhesion.
   9. ASTM E96: Permeance.

B. Applicator qualifications:
   1. Not less than 5 similar sized projects with material specified.

1.04 SUBMITTALS

A. Product data:
   1. Manufacturer’s standard catalog cut sheets indicating product to be used, conformance to specifications, and installation procedures and details.
   2. Submit test data from manufacturer on proposed waterproofing system.

B. Project information:

1. Manufacturer certification of installer qualifications.
2. Product test reports from qualified independent testing agency evidencing compliance of waterproofing with physical properties and other requirements based on comprehensive testing in accordance with specified test methods within previous 5 years.

C. Shop Drawings:
1. Submit shop drawings showing penetrations, sheet layout, special conditions, and details not standard with the manufacturer.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications:
1. Not less than 5 years successful experience on projects of similar size and scope using materials of the type indicated.
2. Waterproofing membrane products used on this project shall be of one manufacturer, unless noted specifically otherwise herein. Manufacturer must have not less than 3 years successful experience in the manufacture of the required materials.

1.06 WARRANTY

A. Provide written warranty signed jointly by installer and manufacturer.

B. Warranty waterproof integrity of installation, adhesion to substrate and against surface degradation.

C. Warranty installation for period of 5 years from date of substantial completion.

1.07 PRE-INSTALLATION MEETING

A. Hold pre-installation meeting directed by Contractor prior to beginning of waterproofing to discuss following as a minimum:
1. Contract Document requirements.
2. Extent of waterproofing.
3. Substrate conditions, preparation, pretreatment, and curing periods.
4. Waterproofing manufacturer’s specifications and details.
5. Special details, flashings, and termination provisions.
6. Installation procedures and schedule.
7. Inspection, testing, and repairs.
8. Protection from damage by other work and environmental exposures.

B. Prior to pre-construction meeting, issue for Contractor review:
1. Installation drawings.
2. Manufacturer’s product data.
3. Product test reports.
4. Sample warranty.

C. Other information deemed pertinent for sound and secure application.

D. Include review of specifications, details, application requirements, and preparatory work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original packages with seals unbroken, labeled with manufacturer’s name, product, date of manufacturer, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by waterproofing manufacturer.
1. Protect stored materials from direct sunlight.

1.09 JOB CONDITIONS

A. Verify suitability of substrate to accept installation.
1. Fill voids, thoroughly dry surface and remove dust.
2. Cure concrete surfaces for minimum 7 days prior to application of waterproofing.

B. Install only when surface temperature are above 40 Deg F.

C. Do not install on wet or frosted surface, or when rain or snow is expected.

D. Provide adequate ventilation during installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Acceptable manufacturers:
   1. Below-grade Wall Waterproofing System:
      a. “Bituthene 3000” by GCP Applied Technologies.
      b. Carlisle Coatings and Waterproofing Incorporated.
      c. Polyguard Products, Inc.
      d. W.R. Meadows.
   2. Underslab Waterproofing System:
      a. “Preprufe 300R” by GCP Applied Technologies.
   3. Below-grade Slab Over Basement Waterproofing System:
      a. “Bituthene Deck System” by GCP Applied Technologies.
      b. Carlisle Coatings and Waterproofing Incorporated.
      c. Polyguard Products, Inc.
      d. W.R. Meadows.
   4. Substitution:
      a. Request for substitutions will be considered in accordance with Section 01 25 13.

B. Wall Waterproofing System:
   1. Self-adhesive rubberized asphalt composite sheet membrane:
      a. Total minimum thickness: 60 mil (1.524 mm) thick, composite sheet consisting of:
         1) Minimum 56 mil (1.4224 mm) thick rubberized asphalt membrane laminated to;
         2) Minimum 4 mil (0.1016 mm) thick cross-laminated polyethylene film with release liner on adhesive side.
   2. Sheet shall be formulated for use with ambient and substrate temperatures at time of installation, and for use with primer or surface conditioner complying with VOC limits of authorities having jurisdiction.
   3. Provide waterproofing complying with following physical properties:
      a. Membrane Tensile strength: Minimum 325 PSI; ASTM D412.
      b. Ultimate elongation: Minimum 300 percent; ASTM D412.
      c. Crack Cycling at -32 degrees: No effect when tested in accordance with ASTM C836
      d. Membrane Puncture Resistance: Minimum 50 LBS; ASTM E154.
      e. Peel Adhesion, concrete: 9 LBS/IN when tested in accordance with ASTM D903.
      f. Lap Adhesion, membrane: 4 LB/IN when tested in accordance with ASTM D1876.
      g. Vapor Transmission, Maximum Permeance: 0.05 Perms when tested in accordance with ASTM E96.
      h. Water absorption: Maximum 0.10 percent when tested in accordance with ASTM D570.

C. Underslab Waterproofing System:
   1. Pre-applied waterproofing membrane integrally bonded to poured concrete.
      a. Total minimum thickness 0.046 IN.
   2. Provide waterproofing complying with the following properties:
      a. Membrane Tensile strength: Minimum 4000 PSI; ASTM D412.
      b. Ultimate elongation: Minimum 300 percent; ASTM D412.
      c. Crack Cycling at – 10 degrees: No effect when tested in accordance with ASTM C836.
      d. Membrane Puncture Resistance: Minimum 221 LBS; ASTM E154.
      e. Peel Adhesion, concrete: 5 LBS/IN when tested in accordance with ASTM D903.

f. Lap Adhesion, membrane: 2.5 LB/IN when tested in accordance with ASTM D1876.
g. Vapor Transmission, Maximum Permeance: 0.01 Perms when tested in accordance with ASTM E96.
h. Water absorption: Maximum 0.5 percent when tested in accordance with ASTM D570.

D. Below-grade Slab Over Basement Waterproofing System:
1. Self-Adhesive rubberized asphalt composite sheet membrane:
a. Total minimum thickness: 60 mil (1.524 mm) thick, composite sheet consisting of:
1) Minimum 56 mil (1.4224 mm) thick rubberized asphalt membrane laminated to;
2) Minimum 4 mil (0.1016 mm) thick cross-laminated polyethylene film with release liner on adhesive side.
2. Surface Conditioner and compatible accessory products.
3. Sheet shall be formulated for use with ambient and substrate temperatures at time of installation, and for use with primer or surface conditioner complying with VOC limits of authorities having jurisdiction.
4. Provide waterproofing complying with following physical properties:
a. Membrane Tensile strength: Minimum 325 PSI; ASTM D412.
b. Ultimate elongation: Minimum 300 percent; ASTM D412.
c. Crack Cycling at -32 degrees: No effect when tested in accordance with ASTM C836.
d. Membrane Puncture Resistance: Minimum 50 LBS; ASTM E154.
e. Peel Adhesion, concrete: 9 LB/IN when tested in accordance with ASTM D903.
f. Lap Adhesion, membrane: 5 LB/IN when tested in accordance with ASTM D1876.
g. Vapor Transmission, Maximum Permeance: 0.05 Perms when tested in accordance with ASTM E96.
h. Water absorption: Maximum 0.10 percent when tested in accordance with ASTM D570.
5. Drainage Board
6. Asphalt hardboard protection course.

E. Accessories materials:
1. Furnish accessories materials recommended by waterproofing manufacturer for intended use, compatibility with waterproofing sheet membrane and application temperature:
a. Furnish liquid-type auxiliary materials that also comply with VOC limits of authorities having jurisdiction.
2. Surface Primer: CCW liquid primer recommended by manufacturer of sheet waterproofing material for substrate and application temperatures.
3. Sheet flashing:
a. Self-adhering, polymer-modified rubberized-asphalt composite sheet of same material, construction, and thickness as waterproofing sheet membrane.
4. Liquid membrane:
a. Elastomeric, 2-component, liquid, cold fluid-applied, trowel grade, or low viscosity as recommended by waterproofing manufacturer for application.
5. Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
6. Waterstop:
a. Non-bentonite waterstop for non-moving concrete construction joints.

F. Protection course fabric:
1. Vertical applications:
a. Asphalt Hardboard:
1) Premolded semi-rigid protection board as recommended by the membrane manufacturer.

G. Drainage Composite Panels:
1. Prefabricated drainage composite for vertical applications:

a. Provided to promote positive drainage while serving as a protection course.

H. Rigid Board Insulation applications: Specified in Section 07 21 00.

I. Miscellaneous Materials:
1. Surface conditioner, mastic, liquid membrane, tape and accessories as acceptable to manufacturer of sheet membrane waterproofing.

PART 3 EXECUTION

3.01 PREPARATION

A. Cure normal weight concrete minimum of 7 days, and 14 days for lightweight concrete with moisture content acceptable to waterproofing manufacturer.
1. Verify substrate is visible dry and free of moisture.
2. Test for capillary moisture by plastic sheet method according to ASTM D4263.

B. Clean, prepare and treat substrate according to manufacturer's written instructions, to provide clean, dust-free, and dry substrate for waterproofing application.

C. Mask off adjoining surfaces not receiving waterproofing to prevent spillage affecting other construction.

D. Remove grease, oil, form release agents, paints, and other penetrating contaminants from concrete.

E. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

F. Prepare, treat, and cover expansion joints and discontinuous joints according to the manufacturer's written instructions.

G. Prepare, fill, prime, and treat joints and cracks in substrate:
1. Remove dust and dirt from joints and cracks according to ASTM D4258.

H. Prime as recommended by manufacturer.

3.02 MEMBRANE INSTALLATION – PENETRATION, TRANSITION AND TERMINATION DETAILS

A. Construction joint, control joints, cracks and voids exceeding 1/16 IN: Fill with liquid membrane and install 8 IN membrane strip.

B. Expansion joints where anticipated movement is less than ½ IN: Install 3-ply membrane system as recommended by manufacturer.

C. Vertical Inside and Outside Corners: Prepare, prime, and treat inside corners according to waterproofing manufacturer's writing instructions:
1. Install 12 IN membrane strip centered over vertical corners.

D. Horizontal Inside corners including foundation wall to footing intersections: Prepare, prime, and treat inside corners according to waterproofing manufacturer's written instructions:
1. Install ¾ IN fillets of liquid membrane.
2. Extend liquid membrane each direction from corner or install membrane strip centered over corner.

E. Horizontal outside corners: Prepare and treat outside corners according to waterproofing manufacturer's written instructions.
1. Apply double layer overlapping membranes.

F. Drains:
1. Apply a double layer of membrane extending 12 inches (304.8 mm) beyond drain.
2. Install field sheet centered over drain.

G. Pipes, posts, conduits, and similar penetrations:
1. Apply a double layer of membrane extending out at least 6 inches (152.4 mm) from the penetrating item in all directions.
2. Seal with mastic or liquid membrane product.

3. Coordinate detailing at penetrations made after waterproofing system is complete with subcontractors responsible for penetrations.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at protrusions according to waterproofing manufacturer's written instructions.
   1. At top of wall conditions: Terminate membrane below final grade.
      a. Apply mastic to terminations and joints.

3.03 SELF-ADHERING COMPOSITE SHEET APPLICATION

A. Install self-adhering composite sheet according to waterproofing manufacturer's written instructions.

B. Apply primer to substrate at required rate and allow to dry:
   1. Limit priming to areas that will be covered by waterproofing membrane in same day.
   2. Re-prime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheet membrane over area to receive waterproofing:
   1. Accurately align sheets and maintain uniform 2 ½ inches minimum lap widths and end laps.
   2. Overlap and seal seams and stagger end laps to ensure watertight installation.
   3. Roll laps of membrane installed on vertical surfaces, and roll membrane on sloping an horizontal surfaces.

D. Apply continuous sheet membrane over membrane strips bridging each type of joint to dimensions required by manufacturer.

E. Seal exposed edges of membrane terminations.

F. Install sheet membrane and auxiliary materials to tie in adjacent waterproofing.

G. Repair tears, voids, and lapped seams in waterproofing not meeting requirements:
   1. Slit and flatten fishmouths and blisters.
   2. Patch with sheet membrane extending 6 inches (152.4 mm) beyond repaired areas.

H. Waterproofing Membrane must not be left exposed to construction traffic or ultraviolet rays for a period exceeding 10 days without protection.

3.04 HORIZONTAL SURFACE FLOOD TEST:

A. Prior to placing of the finish concrete slab on horizontal surfaces, the areas shall be given 48 hour 2 inches (50.8 mm) deep minimum flood test.

B. Drains shall be plugged, and barriers placed to contain the water.

C. 24 hours prior notification of the test shall be given to the Architect and manufacturer of the sheet membrane.

3.05 PROTECTION COURSE INSTALLATION

A. Install protection course over waterproofing membrane using tape or adhesive according to manufacturer's written instructions and before commencing subsequent construction operations.

B. Do not penetrate waterproofing, and do not use stick clips to install protection course.

C. Minimize exposure of membrane.

3.06 DRAINAGE PANEL INSTALLATION

A. Place and secure drainage panels according to manufacturer's written instructions.

B. Use adhesives and mechanical fasteners recommended by manufacturer and that do not penetrate waterproofing.

C. Do not penetrate waterproofing, and do not use stick clips to install protection course.

D. Lap edges and ends of geotextile to maintain continuity.

E. Protect installed panels during subsequent construction.

F. Adhesively attach drainage board at top-of-wall termination.
   1. Hold top of composite drainage board 6 inches (152.4 mm) below finish grade.
   2. Fold fabric over and tuck into wall in such a way that will avoid intrusion of backfill material into the drainage channels.

3.07 PROTECTION AND CLEANING

A. Protect waterproofing from damage and wear during application and remainder of construction period, according to manufacturer's written instructions.

B. Protect installed system from damage due to ultraviolet light exposure, physical abuse, and other causes.
   1. Provide temporary coverings where system will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 13 26

SECTION 07 18 20
PENETRATION FLOOR SEALER

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Application of penetrating concrete sealer to floors.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data:
   1. Submit manufacturer’s instructions for methods and application procedures.
   2. Certification by sealer manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

C. Samples
   1. Apply sealer to sample test area to illustrate lack of color change and lack of surface sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:
   1. Scotch-Clad Brand 6000H, as manufactured by 3M.
   2. BSM 40 VOC, as manufactured by Chem-trete.
   3. Klere-Seal 940-S, as manufactured by Pecora Corporation.
   4. Exi-Guard CS20, as manufactured by Aegis Coating Technologies.

2.02 MATERIALS

A. Silane/Siloxane based, penetrating, non-surface forming concrete sealer. Tint color as selected by Owner/architect.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify surfaces to receive penetrating sealer are clean, free of efflorescence, oil, grease, topical film forming curing agents, or other foreign matter detrimental to application.

B. Remove loose particles and foreign matter. Remove grease or oil with a solvent, affective alkaline cleaner, or detergent as instructed by sealer manufacturer. Scrub surfaces with water.

C. Allow surfaces to dry before application.

3.02 APPLICATION

A. Apply sealer in accordance with manufacturer's instructions.

B. Apply in 2 continuous, uniform applications.

C. Protect adjacent surfaces not scheduled to receive sealer. If applied on unscheduled surfaces, remove immediately, by manufacturer approved method.

END OF SECTION 07 18 20

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermal/acoustical insulation where shown on drawings or required.

B. Batt insulation used for thermal and sound insulation in stud walls, above lay-in ceiling panels, and where shown on drawings or required.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2026.

1.03 RELATED WORK

A. Section 07 11 13, Bituminous Dampproofing.

B. Section 09 51 00, Acoustical Ceilings: Insulation of acoustical insulation above lay-in ceiling panels as specified.

C. Division 23 – Mechanical: Duct insulation.

1.04 SUBMITTALS

A. Product Data:
   1. Manufacturer’s literature on each insulation type specified.
   2. Manufacturer’s installation instructions for each insulation type specified.

B. Samples: Six (6) inch x six (6) inch piece of rigid insulation for the Architect’s approval.

C. Certifications:
   1. Manufacturer’s certification of compatibility of rigid insulation with dampproofing mastic.
   2. Manufacturer’s affidavit that materials used in Project contains no asbestos.

1.05 COORDINATION

A. Furnish acoustical insulation to acoustical lay-in ceiling contractor for laying insulation above lay-in ceiling panel system specified.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS / PRODUCTS

A. Specifications are based on any of the manufacturers listed below, with their product in parenthesis for the particular insulation application. Other manufacturers not listed must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 regarding substitutions to be considered.
   1. Rigid Wall Insulation:
      a. Extruded Polystyrene Foam Board:
         1) Dow Chemical Co. (Styrofoam Cavitymate Plus)
         2) Owens-Corning (Foamular CW25)
         3) Pactiv Building Products (GreenGuard-SB)
   2. Batt Thermal Insulation:
      a. Walls: For use in partition thermal applications.
         1) Silvercoat (Energy Saver FP)

2) CertainTeed Corp. (AcoustaTherm)
3) Guardian Fiberglass, Inc. (Thermal & Sound Control Batts)
4) Johns-Manville (Thermal-SHEILD Thermal Insulation)
5) Knauf Insulation (QuietTherm Insulation)
6) Owens-Corning (Thermal Batt Insulation)

3. Batt Acoustical Insulation (Sound Attenuation):
   a. Walls: For use in partition acoustical applications.
      1) CertainTeed Corp. (CertaPro AcoustaTherm)
      2) Guardian Fiberglass, Inc. (Thermal & Sound Control Batts)
      3) Johns-Manville (Sound-SHEILD Sound Control Batts)
      4) Knauf Insulations (QuietTherm Insulation)
      5) Owens-Corning (Sound Batt)

2.02 MATERIALS

A. Rigid Wall Insulation
   1. Extruded polystyrene foam board
      a. Type: ASTM C518.
      b. Thickness / R-Value (minimum):
         1) 1-inch / R-5 where shown on drawings.
      c. Surface burning characteristics:
         1) Flame Spread: 10 or less
         2) Smoke developed: 175 or less

B. Batt Insulation:
   1. Thermal Insulation:
      a. Type: ASTM C665, Type 1, unfaced
      b. Thickness / R-Values (minimum):
         1) 6-inches / R-19 where shown on drawings.
         2) 10-inches / R-30 where shown on drawings.
      c. Surface Burning characteristics:
         1) Flame Spread: 25 or less
         2) Smoke developed: 50 or less
   2. Acoustical (Sound Attenuation) Insulation:
      a. Type: ASTM C665, Type 1, unfaced
      b. Surface Burning Characteristics:
         1) Flame Spread: 25 or less
         2) Smoke Developed: 50 or less
      c. Thickness / R-Values (minimum):
         1) 3½-inches / R-13 where shown on drawings.
         2) 6-inches / R-19 where shown on drawings.

C. Cavity Insulation for Sound Rated Partitions:
   1. Cavity insulation for sound rated partitions may be fiberglass or mineral fiber with a density of 0.7 lb/ft3. Thickness shall be as called out on drawings. It shall be unfaced and supplied in batts. Flame spread and smoke-developed index not to exceed 25, per ASTM E84. Material shall be non-combustible per ASTM E136.
   2. Material to be placed in the cavity friction-fit snug against the wallboard with no gaps between batts. Butt ends of batts together. Install behind electrical outlets, around structural obstructions, jambs, sills, etc.
   3. The following are acceptable, subject to the above:
      a. Sound Attenuation Batt Insulation from Owens Corning Fiberglass Corporation, Toledo, OH 800-438-7465
      b. Noise Reducer Batts from CertainTeed, Valley Forge, PA 215-341-7000
      c. Thermal Shield from Johns Manville, Dever, CO 800-654-3103

d. Quiet Therm from Knauf Insulation, Shelbyville, IN 317-398-4434

D. Core-Fill Insulation at CMU Block
1. Reference Section 04 20 00 Unit Masonry

E. Fiberglass Board
1. Fiberglass board shall be 1" – 4" thick and have a density of 2.25 to 6.0 lbs/3 ft. The thickness and density will vary depending on the application, and will be called out in the drawings. It shall be unfaced and supplied in rigid, continuous boards. Flame spread and smoke-developed index not to exceed 25, per ASTM E84. Material shall be non-combustible per ASTM E136.
2. The following are acceptable, subject to the above:
a. Industrial Insulation Type 705 unfaced, from Owens Corning Fiberglass Corporation, Toledo, OH 419-248-8000
b. Insulation Board from Knauf Insulation, Shelbyville, IN 317-398-4434
c. Industrial Insulation Board IB 600 from CertainTeed, Valley Forge, PA 215-341-7000
d. Type Insul-Sheild I/S 600 from Johns Manville Mechanical Insulation Division, Denver, CO 800-654-3103

F. Miscellaneous Materials:
1. Mechanical Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be adhered or mechanically fastened to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
2. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Rigid Board Insulation:
1. Install board insulation in accordance with manufacturer's printed instructions.
2. Cut insulation to fit snugly around obstruction such as vents, pipe or conduit.
3. Install board insulation with joints tight and provide full coverage.

B. Batt Insulation (Thermal and Sound):
1. Walls:
a. Insulation shall be friction fit between studs and provide full coverage where indicated on drawings.
b. Insulation shall be tight within spaces in partitions, around cut opening, behind and around electrical and mechanical items within or behind partitions and tight to items passing through partitions.
c. For metal framed wall cavities where cavity heights exceed 96 inches (2438.4 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
d. Maintain 3 inch (76.2 mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
e. Wall areas above ceiling: At sidewall insulation in ceiling cavity, install adhesive-mounted impaling devices with metal caps at 2 feet (60.96 cm)-0 inches (0 mm) vertically and at four (4) inches from each side of blankets horizontally. Install blankets with four (4) foot dimension running vertically on spikes, keeping blankets tight to the exterior wall without crashing into each other.

END OF SECTION 07 21 00

SECTION 07 25 00
WEATHER BARRIER

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure; 2017, with Editorial Revision (2019).

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

D. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2018.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

F. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

G. 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 (Reapproved 2023).

H. ASTM E1677 - Standard Specification for Air Barrier (AB) Material or Assemblies for Low-Rise Framed Building Walls; 2025.

I. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

J. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2025.

1.02 SUMMARY

A. Section Includes:
   1. Weather Barrier Membrane
   2. Seam Tape
   3. Flashing
   4. Fasteners

1.03 REFERENCES

A. ASTM International
   1. ASTM C920; Standard Specification for Elastomeric Joint Sealants
   2. ASTM C1193; Standard Guide for Use of Joint Sealants
   3. ASTM D882; Test Method for Tensile Properties of Thin Plastic Sheeting
   4. ASTM D1117; Standard Guide for Evaluating Non-woven Fabrics
   5. ASTM E84; Test Method for Surface Burning Characteristics of Building Materials
   6. ASTM E96; Test Method for Water Vapor Transmission of Materials
   7. ASTM E1677; Specification for Air Retarder Material or System for Framed Building Walls
   8. ASTM E2178; Test Method for Air Permeance of Building Materials
   9. ASTM E2357; Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

B. AATCC – American Associate of Textile Chemists and Colorists
   1. Test Method 127 Water Resistance: Hydrostatic Pressure Test

C. TAPPI
   1. Test Method T-40; Grams of Paper and Paperboard (Weight per Unit Area)
   2. Test Method T-460; Air Resistance (Gurley Hill Method)

1.04 SUBMITTALS

A. Refer to Section 01 33 00 Submittal Procedures

B. Product Data: Submit manufacturer current technical literature for each component.

C. Samples: Weather Barrier Membrane, minimum 8-1/2 inches (216 mm) by 11 inch (279.4 mm).

D. Quality Assurance Submittals
   1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
   2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
   3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier assembly installation.

E. Closeout Submittals
   1. Refer to Section 01 78 00 Closeout Submittals.
   2. Weather Barrier Warranty: Manufacturer's executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.05 QUALITY ASSURANCE

A. Qualifications
   1. Installer shall have experience with installation of weather barrier assemblies under similar conditions.
   2. Installation shall be in accordance with weather barrier manufacturer's installation guidelines and recommendations.
   3. Source Limitations: Provide weather barrier and accessory materials produced by single manufacturer.

B. Mock-up
   1. Install mock-up using approved weather barrier assembly including fasteners, flashing, tape and related accessories per manufacturer's current printed instructions and recommendations.
      a. Mock-up size: 10 feet (304.8 cm) by 10 feet.
      b. Mock-up Substrate: Match wall assembly construction, including window opening.
      c. Mock-up may not remain as part of the work.
   2. Contact manufacturer's designated representative prior to weather barrier assembly installation, to perform required mock-up visual inspection and analysis as required for warranty.

C. Pre-installation Meeting
   1. Refer to Section 01 31 19 Project Meetings.
   2. Hold a pre-installation conference, two weeks prior to start of weather barrier installation. Attendees shall include Contractor, Architect, Engineer, Consultant, Installer, Owner's Representative, and Weather Barrier Manufacturer's Designated Representatives.
   3. Review all related project requirements and submittals, status of substrate work and preparation, areas of potential conflict and interface, availability of weather barrier assembly materials and components, installer's training requirements, equipment, facilities and scaffolding, and coordinate methods, procedures and sequencing requirements for full and proper installation, integration and protection.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 01 60 00 Product Requirements.

B. Deliver weather barrier materials and components in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Store weather barrier materials as recommended by weather barrier manufacturer.

1.07 SITE CONDITIONS

A. Install weather barrier only when site weather conditions are acceptable per manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Basis of Design: Spunbonded polyolefin, non-woven, non-perforated, weather barrier is based upon DuPontTM Tyvek® CommercialWrap® and related assembly components.

B. Performance Characteristics:
   1. Air Penetration: 0.001 cfm/ft2 at 75 Pa, when tested in accordance with ASTM E2178. Type I per ASTM E1677. ≤0.04 cfm/ft2 at 75 Pa, when tested in accordance with ASTM E2357.
   2. Water Vapor Transmission: 28 perms, when tested in accordance with ASTM E96, Method B.
   3. Water Penetration Resistance: Minimum 9.19 feet (280 cm) when tested in accordance with AATCC Test Method 127.
   4. Basis Weight: Minimum 2.7 oz/yd2, when tested in accordance with TAPPI Test Method T-410.
   5. Air Resistance: Air infiltration at >1500 seconds, when tested in accordance with TAPPI Test Method T-460.
   6. Tensile Strength: Minimum 38/35 lbs/in., when tested in accordance with ASTM D882, Method A.
   7. Tear Resistance: 12/10 lbs., when tested in accordance with ASTM D1117.
   8. Surface Burning Characteristics: Class A, when tested in accordance with ASTM E84. Flame Spread: 10. Smoke Developed: 10.

2.02 INSTALLATION ACCESSORIES

A. Seam Tape: As recommended by the weather barrier manufacturer.

B. Fasteners:
   1. 1-5/8 inch (41 mm) rust resistant screw with 2-inch diameter plastic cap or manufacturer approved 1-¼” or 2” metal gasketed washer.

C. Sealants:
   1. Provide sealants that comply with ASTM C920, elastomeric polymer sealant to maintain watertight conditions.
   2. Products: Sealants recommended by the weather barrier manufacturer.

D. Adhesives:
   1. Provide adhesives recommended by weather barrier manufacturer.
   2. Products: Adhesives recommended by the weather barrier manufacturer.

E. Primer:
   1. Provide flashing manufacturer recommended primer to assist in adhesion between substrate and flashing.
   2. Products: Primers recommended by the flashing manufacturer.

F. Flashing:
   1. Flexible membrane flashing materials for window openings and penetrations recommended by manufacturer.
   2. Thru-Wall flashing membrane materials for flashing at changes in direction or elevation (shelf angle, foundations, etc.) and at transitions between different assembly materials.
   3. Preformed Inside and Outside Corners and End Dams: Preformed three-dimensional shapes to complete the flashing system used in conjunction with Thru-Wall Flashings.

PART 3 EXECUTION

3.01 EXAMINATION AND INSTALLATION

A. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.

B. Install weather barrier over exterior face of exterior wall substrate in accordance with manufacturer recommendations.

C. Install weather barrier prior to installation of windows and doors.

D. Start weather barrier installation at a building corner, leaving 6-12 inches (304.8 mm) of weather barrier extended beyond corner to overlap.

E. Install weather barrier in a horizontal manner starting at the lower portion of the wall surface with subsequent layers installed in a shingling manner to overlap lower layers. Maintain weather barrier plumb and level.

F. Sill Plate Interface: Extend lower edge of weather barrier over sill plate interface 3-6 inches (152.4 mm). Secure to foundation with elastomeric sealant as recommended by weather barrier manufacturer.

G. Window and Door Openings: Extend weather barrier completely over openings.

H. Overlap weather barrier:
   1. Exterior corners: Minimum 12 inches (304.8 mm).
   2. Seams: Minimum 6 inches (152.4 mm).

I. Weather Barrier Attachment:
   1. Attach weather barrier to studs through exterior sheathing. Secure using weather barrier manufacturer recommended fasteners, space 12-18 inches (457.2 mm) vertically on center along stud line, and 24 inch (609.6 mm) on center, maximum horizontally.

J. Apply flashing to weather barrier membrane prior to installing cladding anchors.

3.02 SEAMING

A. Seal seams of weather barrier with seam tape at all vertical and horizontal overlapping seams.

B. Seal any tears or cuts as recommended by weather barrier manufacturer.

3.03 FLASHING

A. Cut flexible flashing a minimum of 12 inches (304.8 mm) longer than width of sill rough opening.

B. Cover horizontal sill by aligning flexible flashing edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches (152.4 mm). Secure flashing tightly into corners by working in along the sill before adhering up the jambs.

C. Fan flexible flashings at bottom corners onto face of wall. Firmly press in place. Mechanically fasten fanned edges.

D. Apply 9-inch wide strips of flashing at jambs. Align flashings with interior edge of jamb framing. Start flashing at head of opening and lap sill flashing down to the sill.

E. Spray-apply primer to top 6 inches (152.4 mm) of jambs and exposed sheathing.

F. Install flexible flashing at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches (50.8 mm).

G. Coordinate flashing with window installation.

H. On exterior, install backer-rod in joint between window frame and flashed rough framing. Apply sealant at jambs and head, leaving sill unsealed. Apply sealants in accordance with sealant manufacturer's instructions and ASTM C1193.

I. Position weather barrier head flap across head flashing. Adhere using flashing over the 45-degree seams.

J. Tape top of window in accordance with manufacturer recommendations.

K. On interior, install backer rod in joint between frame of window and flashed rough framing. Apply sealant around entire window to create air seal. Apply sealant in accordance with sealant manufacturer's instructions and ASTM C1193.

L. At thru-wall flashing at Base of Wall:

1. Overlap thru-wall flashing with weather barrier by 6-inches.
2. Mechanically fasten bottom of weather barrier through top of thru-wall flashing.
3. Seal vertical and horizontal seams with tape or sealing membrane.

M. At thru-wall flashing at Window Head
1. Cut flap in weather barrier at window head.
2. Prime exposed sheathing.
3. Install lintel as required. Verify end dams extend 4 inches (101.6 mm) minimum beyond opening.
4. Install end dams bedded in sealant.
5. Adhere 2 inches (50.8 mm) minimum thru-wall flashing to wall sheathing. Overlap lintel with thru-wall flashing and extent ¼ inch minimum beyond outside edge of lintel to form drip edge.
6. Apply sealant along thru-wall flashing edges.
7. Fold weather barrier flap back into place and tape bottom edge to thru-wall flashing.
8. Tape diagonal cuts of weather barrier.
9. Secure weather barrier flap with fasteners.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's design repetitive shall be notified as required for observations of weather barrier assembly installation.

3.05 FIELD INSPECTION AND TESTING

A. Testing Agency: General Contractor shall engage a qualified testing agency with direct oversight by an engineer licensed in the State of Texas to perform a forensic inspection of the product, assembly and performance. Testing and documentation of weather barrier installation shall be performed prior to concealment.
1. Inspection: Weather barrier system materials, accessories and installation are subject to inspection for compliance with specified requirements, including:
a. Continuous structural support of weather barrier system has been provided.
b. Compatibility of materials within weather barrier system and with adjacent materials.
c. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions and mortar droppings. Moisture level of surfaces are within limits set by Manufacturer for optimal installation.
d. Exterior sheathing exposed surfaces are smooth, clean dry and intact with no visible damage with all joints sealed and/or taped.
e. All required penetrations through weather barrier system, including those required under different scope of work, are in place in exterior wall surface and ready for membrane application.
f. Site conditions for application temperature and dryness of substrates have been maintained for time period set by Manufacturer for optimal installation.
g. Surfaces have been primed, if applicable.
h. Continuity of weather barrier system has been achieved throughout the opaque wall area with no gaps or holes.
i. Wet and dry film thickness of fluid-applied membrane complies with Manufacturer's recommended minimum thickness.
j. Connections between assemblies (metal flashing at openings, roof membrane, waterproofing, and weather seals with weather barrier system) are in compliance with approved shop drawings requirements and that continuity of seal has been maintained.
k. Laps in self-adhered transition membrane strips and through-wall flashing membranes have complied with minimum requirements set by Manufacturer and have been shingled in the correct direction, with no fishmouths.

l. All self-adhered membranes have been firmly adhered to substrate and all exposed cut edges have been encapsulated with Manufacturer approved sealant. Sealant to be tooled to membrane surfaces to ensure adhesion.
m. Transition at changes in direction and structural support at gaps have been provided and all anticipated movements accommodated.
n. All penetrations have been sealed in accordance with approved shop drawings and Manufacturer's recommendations.
o. Maximum exposure time of materials to UV deterioration has not been exceeded. Those materials which exceed maximum exposure time will have to be replaced or recovered in accordance with Manufacturer's written recommendations.

2. Field Testing of weather barrier assembly to be conducted just to prior installation of exterior wall covering and include exterior sheathing joints, transitions, penetrations, openings, and exterior wall covering anchorage devices that penetrate weather barrier if possible. If openings are included completed fixed fenestration frames and weather seals are to be installed prior to test for water tight assembly. No interior finishes or insulation should be installed for full visibility of inboard side of support substrate. Test chamber to span from slab to slab vertically and at least 10 feet (304.8 cm) wide. Field testing to include:
   a. Weather Leakage: Tested in accordance with ASTM E783, latest edition. Maximum allowable leakage for the weather barrier assembly to be 0.04 cfm/ft2 (0.2 L/(s·m2)) at a static pressure differential of 1.57 psf (75 Pa).
   b. Water Penetration: Tested in accordance with ASTM E1105 – Procedure A, latest edition at a uniform static pressure differential of 10psf (479 Pa). No water visible on any interior surfaces allowed including structure, support studs or inboard surface of exterior sheathing.

B. Written reports documenting observations made during inspections and results of field testing to be submitted to Owner, Architect, and Contractor within five working days of the inspection and performance of field testing.

C. A minimum of three inspections and field tests are to be conducted during the installation of the weather barrier assembly. Out of sequence work is to be scheduled in test areas so as not to delay field testing schedule. Field testing to be conducted at 10%, 50%, and 80% completion of the installation. Depending upon results of initial inspections and field tests Owner reserves the right to require increased frequency of inspection visits and field testing.

D. Correct deficient applications not passing tests and inspections, make necessary repairs, and retest as required to demonstrate compliance with performance requirements at no additional cost to Owner.

3.06 PROTECTION AND CLEANING

A. Take measures required to protect completed installation.

END OF SECTION 07 25 00

SECTION 07 26 00
SLAB VAPOR BARRIER

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. 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; 2024.

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.02 SUMMARY

A. Products supplied under this section:
   1. Vapor barrier and installation accessories for installation under concrete slabs.

B. Related sections:
   1. Section 03 30 00 Cast-In-Place Concrete
   2. Section 07 26 00 Vapor Retarders

1.03 REFERENCES

A. ASTM International
   1. ASTM E1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   2. ASTM E1643-18a Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference – American Concrete Institute (ACI):
   1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
   2. ACI 302.1R-15: Guide to Concrete Floor and Slab Construction.

1.04 SUBMITTALS

A. Quality control/assurance:
   1. Summary of test results per paragraph 9.3 of ASTM E1745.
   2. Manufacturer’s samples and literature.
   3. Manufacturer’s installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
   4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.
   5. Contract vapor barrier manufacturer for pre-construction meeting and to coordinate a review of the vapor barrier installation either by digital review or in person.
   6. Vapor barrier manufacturer must warrant in writing (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.
   7. Manufacturer verify in writing 20 years in the industry with no reported product failures.

PART 2 PRODUCTS

2.01 MATERIALS

A. Vapor barrier shall have all of the following qualities:
   1. Maintain permeance of less than 0.01 Perms grains/(ft2 · hr · inHg) as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
   2. Other performance criteria:
      a. Strength: ASTM E1745 Class A.
      b. Thickness: 15 mils (0.381 mm) minimum.
   3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1.

4. Warranty: (a) compliance with the designated ASTM E1745 classification, and (b) no manufacturing defects in the product for, at least, the Life of the Building.

B. Vapor barrier products:
   1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.
   2. Approved Alternate: Vaporguard by Reef Industries, 713-507-4250 www.reefindustries.com.
   3. Approved Alternate: PMPC by W.R. Meadows, 800-342-5976 http://www.wrmeadows.com/pmpc/.
   4. No substitutions.

2.02 ACCESSORIES

A. Seams:
   1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Penetrations of Vapor barrier:
   1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
   2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Perimeter/terminated edge seal.
   1. Stego Crete Claw (texture tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
   2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
   3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
   4. One-sided seaming tape is not a recommended method of sealing at the terminated edge.

D. Penetration Prevention:
   1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
   2. Beast Form Stake by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

E. Vapor Barrier-Safe Screed System
   1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 EXECUTION

3.01 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
   1. Level and compact base material.

B. Contact vapor barrier manufacturer to schedule a pre-construction meeting and to coordinate a review, in-person or digital, of the vapor barrier installation.

3.02 UNSTALLATION

A. Install vapor barrier in accordance ASTM E1643.
   1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement wherever possible.
   2. Extent vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the slab itself using Stego Crete Claw Tape, per manufacturer's instructions. Specifier note: The perimeter seal can be handled several ways. When sealing to the slab, Stego Crete Claw Tape is the best option. When sealing to a stem wall or wall, the best option is to use StegoTack Tape or both StegoTack Tape and a Stego Term

a. Seal Vapor barrier to the entire slab perimeter using Stego Crete Claw Tape with a surface that creates a mechanical seal to freshly-placed concrete, per manufacturer's instructions.
   1) OR
b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with StegoTack Tape, or both Stego Term Bar and StegoTack Tape per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.

3. Overlap joints 6 inches (152.4 mm) and seal with manufacturer's seam tape.
4. Apply seam tape/Stego Crete Claw to a clean and dry vapor barrier.
5. Seal all penetrations (including pipes) per manufacturer's instructions.
6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use Beast Form Stake and Beast Foot as a vapor barrier-safe forming system. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier.
7. Repair damage areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
8. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.
9. General Contractor to notify Architect to perform an onsite inspection with a Stego Wrap representative as part of the Stego Installation Support Program to ensure compliance with ASTM E1643.

END OF SECTION 07 26 00

SECTION 07 26 16
GRADE VAPOR RETARDER

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.02 SUMMARY

A. This Section includes low pressure vapor retarders for installation under concrete slabs on grade.

1.03 SUBMITTALS

A. Product Data: Include manufacturer's written instructions for installation, seaming, technical data, and tested physical and performance properties of vapor retarder.

B. Shop Drawings: Show locations and extent of vapor retarders. Include details for penetrations and terminations, tie-ins with adjoining waterproofing, other termination conditions, and repairs.

C. Product test reports.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer, approved by manufacturer to install manufacturer's products: and who is eligible to receive warranty specified.

B. Pre-installation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

A. Environmental Conditions: Apply vapor retarders retarders within range of ambient and substrate temperatures recommended by manufacturer.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by manufacturer and Installer, and agreeing to repair or replace vapor retarder that does not retard vapor for a period of 5 years after date of Substantial Completion, and to repair consequential damage to flooring and structure.

PART 2 PRODUCTS

2.01 VAPOR RETARDER

A. Vapor Retarder: ASTM E1745, Class C, manufactured specifically for long term below slab use. Vapor retarder shall have a permeance of no more than 0.04 grains/(ft2*hr*in.Hg) per ASTM E 96 or F 1249. Vapor retarder shall maintain permeance after mandatory conditioning tests per ASTM E 154 Sections 8,11,12,13. Retarder to be no less than 15 mils (0.381 mm) thick.

1. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to:
   a. Stego Wrap by Stego Industries.

2.02 AUXILIARY MATERIALS

A. Seam tape, pipe boots, detail strips with vapor permeance not less than the membrane, as required by manufacturer.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Level and tamp or roll substrate.

B. Unroll vapor retarder with longest dimension parallel with direction of pour.

C. Lap vapor retarder over footings and seal to foundation walls.

D. Overlap or butt joints and seal joints as required by manufacturer.

E. Seal membrane penetrations as required by manufacturer.

F. Repair tears, voids, and lapped seams in vapor retarder not complying with requirements. Silt and flatten fishmouths and blisters. Patch with vapor retarder and tape extending beyond repaired areas in all directions.

G. No penetrations of vapor retarder in allowed except for reinforcing steel and permanent utilities, which are to be sealed.

3.02 PROTECTION

A. Protect vapor retarder from damage during installation of reinforcing and utilities.

B. Protect vapor retarder from damage and wear during remainder of construction period.

END OF SECTION 07 26 16

SECTION 07 27 27
APPLIED MEMBRANE AIR & MOISTURE BARRIER

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. All of the Contract Documents, including General and Supplementary Conditions and Division 1 General Requirements, apply to the work of this section.

1.02 SUMMARY

A. The work of this section includes, but is not limited to:
   1. Materials, performance and installation methods for water-resistant, vapor permeable fluid-applied membrane air barrier system, a component of the opaque exterior wall assembly.
   2. Materials and installation methods to bridge and seal water and air leakage pathways at roof and foundation interface, fenestration and door openings, control and expansion joints, masonry ties, piping and other penetrations through the fluid-applied membrane air barrier system.

B. Related Sections: Other specification sections that directly relate to the works of this section include, but are not limited to:
   1. Section 04 20 01 – Unit Masonry
   2. Section 07 13 26 – Self-Adhering Sheet Waterproofing
   3. Section 07 14 13 – Hot Fluid-Applied Rubberized Asphalt Waterproofing
   4. Section 07 42 43 – Metal Composite Material Panels
   5. Section 07 54 23 – Thermoplastic Polyolefin Roofing
   6. Section 07 92 00 – Joint Sealants
   7. Section 08 41 13 – Glazed Aluminum Window Walls

1.03 DEFINITIONS

A. Air Barrier: Material or assembly of materials joined together to provide a barrier to air leakage through the building envelope. Air barrier may be single material or a combination of materials.

B. Water-Resistive Barrier: Material or assembly of materials behind an opaque exterior wall covering that is intended to prevent liquid water which has penetrated through the exterior covering from further intruding into the exterior wall assembly.

C. Vapor Permeable Membrane: Material or assembly of materials having a moisture vapor permeance rating greater than 10 perms (5.7 x 10-10 kg/Pa · s · m2) when tested in accordance with the desiccant method using Procedure B of ASTM E96. A vapor permeable material permits the passage of moisture vapor.

D. Vapor Retarder Membrane: Material or assembly of materials having a moisture vapor permeance rating less than or equal to 10 perms (5.7 x 10-10 kg/Pa · s · m2) when tested in accordance with the desiccant method using Procedure B of ASTM E96. A vapor retarder membrane limits the passage of moisture vapor through the exterior wall assembly. Vapor retarder membranes are divided into three Vapor Retarder Classes defined as:
   1. Class I: Less than or equal to 0.1 perm.
   2. Class II: Greater than 0.1 perm and less than or equal to 1.0 perm.
   3. Class III: Greater than 1.0 perm and less than or equal to 10 perm.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

D. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

E. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100 % Relative Humidity; 2025.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

G. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2025b.

H. 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).

I. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

J. 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 (Reapproved 2023).

K. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

L. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2025.

1.05 REFERENCES

A. Test standards and material specifications from the following organizations are applicable to the extent referenced in the text. Where not specified, latest edition applies.
   1. Air Barrier Association of America (ABBA)
   2. American Society for Testing and Materials (ASTM)
   3. U.S. Environmental Protection Agency (EPA)
   4. International Building Code (IBC), 2006 Edition with Jurisdictional Amendments
   5. International Energy Conservation Code (IECC), 2006 Edition with Jurisdictional Amendments
   6. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
   7. Sealant, Waterproofing, and Restoration Institute (SWRI)
   8. US Green Building Council (USGBC) – Leadership in Energy and Environmental Design (LEED) Green Building Rating System

1.06 PERFORMANCE REQUIREMENTS

A. Provide a continuous vapor permeable fluid-applied water-resistive air barrier membrane system from a single source Manufacturer behind the exterior opaque wall covering as indicated in Contract drawings. System to include all flexible flashings, exterior sheathing joint tapes, metal flashings, liquid sealants and primers required for a complete system to bridge and seal water and air leakage pathways at all interface areas with dissimilar exterior wall coverings, roof and foundation materials.

B. The fluid-applied air barrier membrane shall have the following characteristics:
   1. It must be continuous, with all joints sealed, gasketed, or weather-stripped to minimize air leakage, infiltration and exfiltration. The following areas of the exterior envelope must be joined with the membrane to minimize air leakage:
      a. Joints between air barrier membrane and fenestration, door frames.
      b. Interface between air barrier membrane and foundation waterproofing membrane or structure.
      c. Interface between air barrier membrane and roof membrane.
      d. Interface between air barrier membrane and horizontal, intermediate deck, terrace or canopy waterproofing.
      e. Around all penetrations and openings through air barrier membrane.

2. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
3. It shall be durable or maintainable.
4. It must be capable of resisting the penetration of liquid water from the exterior.
5. It must vapor permeable.
6. Air barrier materials will be compatible with one another and with adjacent materials under conditions of service and application required.
7. Minimum installed dry film thickness or air barrier membrane to be not less than 40 mil (1.016 mm).

C. Air Permeance: Air permeance must be less than 0.004 cfm/ft2 (0.02 L/(s·m2)) at a static test pressure differential of 1.57 lb/ft2 (75 Pa) when tested in accordance with ASTM E2178, latest revision.

D. Air Barrier Assembly Air Leakage: Opaque wall air barrier assembly air leakage rate must be less than 0.04 cfm/ft2 (0.2 L/(s·m2)) at a static pressure differential of 1.57 lb/ft2 (75 Pa) when tested in accordance with ASTM E2357, latest revision.

E. Air Barrier Assembly Water Penetration Resistance: No water penetration on the interior side of the exterior sheathing, stud framing, support structure or masonry substrate within the extent of the air barrier assembly or joints at openings when tested at a minimum static pressure differential of 2.86 lb/ft2 (137 Pa) for 15 minutes in accordance with ASTM E331, latest revision. Specimen to be tested without exterior wall covering and include both vertical and horizontal sheathing joints (minimum 1/8 inch (3.18 mm) joint width) and penetration.

F. Air Barrier Assembly Water Resistance: Tested specimen to be representative of project construction and should include sealing of sheathing joints larger than nominal specified by Manufacturer. There shall be no deleterious effects to membrane after 14 days of exposure to water when tested in accordance with ASTM D2247, latest revision. Deleterious effects would include cracking, checking, erosion or other characteristics that would affect membranes ability to resist liquid water.

G. Water Vapor Permeance: Specimens to be tested in accordance with ASTM E96, Procedure B (Water Method), latest revision, at 75° ± 5° F (24° ± 3° C) with 50 percent relative humidity. Test specimens to be conditioned for a minimum of 40 hours at test atmospheric conditions prior to testing. Water vapor permeance to be greater than 10 perms (5.7 x 10-10ng/Pa·s·m2).

H. Adhesive Bond Strength: Flatwise tensile bond strength of fluid-applied air barrier membrane and self-adhered accessory flashing to substrate, metal flashing accessories, and each other to be a minimum of 15 psi (103.42 kPa) when tested in accordance with ASTM C297, latest revision. Laboratory report must demonstrate that membrane and self-adhered accessory flashing have been tested with materials identical to ones to be used on project.

I. Volatile Organic Content (VOC): Maximum of 250 g/L in accordance with EPA Method 24, 40 CFR 59, Subpart D.

J. Elongation: Minimum 200 percent when tested in accordance with ASTM D412, Die C.

K. Combustion Characteristics: Class A performance material with flame spread index no greater than 25 and smoke development index ne greater than 450 when tested in accordance with ASTM E84, latest revision.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than ten years experience in manufacturing fluid-applied air barrier material and related components as one of its principle products.
1. Submitted air barrier system must have a successful in-situ performance history on a minimum five projects of similar complexity and design within the last five years.
a. Submit list of projects, include project name, location of project and name of property owner.

B. Installer Qualifications: Company with not less than 10 years experience in performing specified work in similar design, products and extent to scope of this project; with a record of successful in-situ performance; and with sufficient production capability, facilities, and trained personnel to install specified items.
   1. Installer and their applicators shall be approved in writing by manufacturer of air barrier system for installation of their products in specified work.
   2. Installer's fulltime on-site field supervisor shall have completed at least three projects of similar complexity and design of similar scope within the last three years.
   3. On-site supervisor and personnel responsible for the installation of specified work shall be trained by technical representative of manufacturer, either at project or manufacturer's facility for:
      a. Proper installation and sequence of work including project specified interface conditions:
      b. Conditions that require special attention or care during installation.
      c. Conditions that should be avoided.
      d. Other topics relevant to installation, including any product installation or in-situ limitations.

C. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum five years experience in providing recommendations, observation, evaluations, and problem diagnostics. Sales representative are not acceptable.

D. Testing Agency Qualifications: Independent, third-party testing agency qualified in accordance with ASTM E329, latest edition for testing indicated.
   1. Testing agencies personnel shall be experienced in the installation of specified air barrier system and qualified to perform field observation and inspection specified in PART 3 – Field Inspection and Testing article to determine the Installer's compliance with specified requirements.

E. Pre-Installation Conference: Prior to commencement of field operations a pre-installation conference shall be held to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.
   1. Required Attendees:
      a. Owner
      b. Architect
      c. Owner's Exterior Wall Consultant
      d. Contractor, including Supervisor
      e. Air Barrier System Installer, including Supervisor
      f. Installers of adjoining work, including supervisors
      g. Testing agency personnel, including supervisors
      h. Air Barrier System Manufacturer's field technical representative
   2. Minimum Agenda:
      a. Review of Contract Document requirements.
      b. Review of approved submittals.
      c. Review of surface preparation, minimum curing period and installation procedures.
      d. Review of special details: interface details with adjoining work, metal flashings, fenestration and door framing, and self-adhered membrane with fluid-applied air barrier membrane for fully coordinating transition between work specified in this section and work of adjoining installers.
      e. Verify compatibility and adhesion of air barrier membrane system with adjoining roof membrane system, below-grade and above-grade waterproofing systems, and exterior weather sealant as applicable with all involved product Manufacturers as it relates to interface details. Approved interface detail must be approved by all adjacent Installers and product Manufacturer's prior to installation for direct or indirect contact.

f. Sequence of installation, responsibilities and schedule for subsequent operations.
g. Review of field mock-up requirements.
h. Review of inspection, testing, product limitations, temporary protection requirements and repair procedures.

3. Reports: Contractor to record discussions, including decisions and agreements reached and prepare report for distribution to meeting attendees.

F. Field Mock-Up: Prior to installation of the air barrier system a field-constructed mock-up shall be provided to verify details and interface with adjoining work to demonstrate the required quality of materials and installation technique.
1. Scope of field mock-up as indicated on Contract drawings.
2. Constructed mock-up in location designed by Contractor and approved by Owner and Architect.
3. Use same Installer personnel, including supervisors, which will perform work on Project.
4. Contract a typical exterior opaque wall assembly incorporating back-up support wall, fenestration and door openings, foundation and roof interface, and other critical junctions. Air barrier system installation to be identical to methodology to be used on project installation.
5. Installation to be layered so key air barrier system interface details with adjoining work is left exposed in completed installation for reference during project installation.
6. Install products according to specified requirements of respective Specification Sections.
7. Work shall demonstrate aesthetic affects and set quality standards for fabrication and installation for air barrier system on project.
8. Obtain approved of mock-up installation from Architect before starting work of this Section.
9. Protect and maintain approved field mock-up during construction in an undisturbed condition as a standard for judging completed work.
10. Do not demolish, alter, or remove until acceptable to Owner and Architect.
11. When directed, demolish and remove from Project site.

G. Inspection and Testing: Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover the installer air barrier system until it has been inspected, tested and approved.

1.08 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical literature for each air barrier system component specified, indicated or required including:
1. Manufacturer's individual system component product data for primary air barrier membrane and accessories.
2. Manufacturer's written installation instructions.
3. Manufacturer's written instructions for evaluating, preparing and treating substrate onto which work will applied.

B. Shop Drawings: Field Mock-Up and Project Shop drawings depicting locations and extent of air barrier system including project specified interface details utilizing project specified materials for:
1. Metal and self-adhered flashing terminations and joinery to fluid-applied membrane.
2. Air barrier closure at penetrations.
3. Membrane termination at fenestration and door openings.
4. Treatment of substrate joints and cracks.
5. Membrane joinery with roof membrane.
6. Membrane joinery with below-grade and above-grade waterproofing if applicable.

C. Warranty: Submit a sample identifying the terms and conditions stated in Article 1.12, Warranty.

1.09 INFORMATION SUBMITTALS

A. Performance Test Reports: Laboratory test reports for air barrier system components demonstrating air barrier system component performance compliance with specified performance criteria. Reports to be:
   1. From an accredited, independent third-party test facility as specified in ASTM E329, latest revision.
   2. Complete, including signature of authorized test facility personnel.
   3. Be formatted to include all required information as described in ASTM E329, latest revision.

B. Quality Assurance Certifications:
   1. Written certification letter from Manufacturer indicating air barrier Manufacturer qualifications are in compliance with specifications requirements.
   2. Written approved of Installer from air barrier system Manufacturer for installation of their system and certification that Installer's field personnel have received installation training as specified.
   3. Written certification letter from Installer indicating that Installer and Installer personnel qualifications are in compliance with specification requirements.
   4. Written certification from the air barrier Manufacturer that the proposed air barrier materials are or are not chemically and adhesively compatible with adjacent roof, waterproofing, and sealant materials.
   5. Written certification indicating products meet project limitations on VOC content.
   6. Written review letter from Manufacturer and Installer of adjoining roof membrane as specified in Section 07 54 23 stating that they have reviewed air barrier system interface details and have tested their roof products with air barrier system for compatibility and adhesion. Letter is to state:
      a. Manufacturer either approves or does not approved direct contact of their roof membrane material with the air barrier system.
      b. Roof Membrane Installer will either comply with or will not comply with Installer's submitted air barrier system interface details with their roof membrane.
      c. Roof membrane warranty provided by both Manufacturer and Installer will not be affected by approved air barrier system interface.
   7. Written review letter from Manufacturer and Installer of adjoining below and above-grade waterproofing as specified in Section 07 13 26 and Section 07 14 13 stating that they have reviewed air barrier system interface details and have tested their waterproofing products with air barrier system for compatibility and adhesion. Letter is to state:
      a. Manufacturer either approves or does not approve direct contact of their waterproofing membrane material with the air barrier system.
      b. Waterproofing Installer will either comply with or will not comply with Installer's submitted air barrier system interface details with their waterproofing membrane.
      c. Waterproofing membrane warranty provided by both Manufacturer and Installer will not be affected by approved air barrier system interface.
   8. Written review letter from Manufacturer and Installer of adjoining exterior weather sealant as specified in Section 07 92 00 stating that they have reviewed air barrier system interface details and have tested their sealant product with air barrier system for compatibility and adhesion. Letter is to state:
      a. Manufacturer either approves or does not approve direct contact of their sealant material with the air barrier system.
      b. Exterior Weather Seal Installer will either comply or will not comply with Installer's submitted air barrier system interface details with their sealant.
      c. Weather sealant warranty provided by both Manufacturer and Installer will not be affected by approved air barrier system interface.

C. Field Inspection and Test Reports: Reports of testing and inspection specified in PART 3 – Field Inspection and Testing article. Include weather conditions, description of work performed,

tests performed, defective work observed, and corrective actions taken to correct defective work.

D. Manufacturer's Field Inspection Reports: Reports of each visit t project site by Manufacturer's Field Technical Representative. Include weather conditions, description of location inspected; identify areas or conditions where installation does not comply with Manufacturer's recommended installation procedure and recommended corrective measures for compliance.

E. NGBS Submittal Requirements:
   1. Statement indicating material costs for each product. Information may be included on schedule of values material cost breakdown or by separate written documentation.
   2. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
   3. Credit MR 5: Address and phone number of location of manufacturer for each product.

1.10 COORDINATE

A. Coordinate installation of work of this Section with adjacent and related work to ensure provision of continuous, unbroken, durable air barrier system.

1.11 DELIVERY, STORAGE AND HANDLING

A. Delivery materials and products in Manufacturer's original unopened labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.

B. Do not double-stack pallets of fluid applied membrane components on the job site. Provide cover on top and all sides, allowing for adequate ventilation

C. Do not store material in areas where temperatures is lower than 50° F (10° C) or where prolonged temperature is above 90° F (32° C).

D. Sequence deliveries to avoid delays but minimize on-site storage.

1.12 PROJECT CONDITIONS

A. Perform work only when existing and forecasted weather conditions are within the limits established by the Manufacturer of the materials used. Proceed with installation only when the substrate construction and preparation work is completed and in condition to receive the fluid-applied air barrier and vapor retarder membrane.

1.13 WARRANTY

A. Manufacturer Warranty: Submit Manufacturer's warranty that fluid-applied air barrier system components are free of defects at time of delivery and are manufactured to meet Manufacturer's published physical properties and material specifications.

B. Installer Warranty: Installer to provide written warranty agreeing to repair or replace fluid-applied air barrier system, including the cost of removal and replacement of the exterior covering, that fails to limit air flow to specified limits and prevent water intrusion through the membrane.

C. Warranty Period: Five years from date of completion of the air barrier membrane installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Single Source Responsibility: Components required for complete air barrier system behind the opaque wall assemblies to be obtained from single manufacturer.

2.02 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide complete vapor permeable fluid-applied air barrier system by one of manufacturers

named below behind the opaque wall covering. If not named, submit as substitution according to Conditions of the Contract and Division 01 Section.

1. Carlisle Coatings & Waterproofing Inc.: www.carlile-ccw.com
2. Grace Construction Products: www.na.graceconstruction.com
3. Henry Company: www.henry.com

2.03 AIR BARRIER MEMBRANE

A. Description: Minimum 40 mil (1.016 mm) dry film elastomeric, synthetic polymer fluid-applied, vapor permeable membrane air barrier complying with specified performance.

B. Acceptable Materials – Synthetic Polymer:
   1. Carlisle Coatings & Waterproofing: Barritech VP
   2. Grace Construction: Perm-A-Barrier VP
   3. Henry Company: Air-Bloc 33MR

2.04 AIR BARRIER ACCESSORIES

A. Flexible Transition Membrane: Transitions between dissimilar substrate, the wrapping of openings.
   1. Description: 36 mil (0.9144 mm) of self-adhesive rubberized asphalt integrally bonded to 4 mil (0.1016 mm) of cross-laminated, high-density polyethylene film to provide a min. 40 mil (1.016 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.
   2. Acceptable Materials:
      a. Carlisle: CCW-705
      b. Grace: Perm-A-Barrier Detail Membrane
      c. Henry Company: Blueskin SA or Blueskin SA HT

B. Flexible Membrane Through-Wall Flashing: For cavity through-wall flashing and air barrier to roof transitions under coping.
   1. Description: 32 mil (0.8128 mm) of self-adhesive rubberized asphalt integrally bonded to 8 mil (0.2032 mm) of cross-laminated, high-density polyethylene film to provide a min. 40 mil (1.016 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.
   2. Acceptable Materials:
      a. Carlisle: CCW-705 TWF
      b. Grace: Perm-A-Barrier Wall Flashing
      c. Henry Company: Blueskin TWF

C. Primer: To promote adhesion of self-adhesive membrane to substrate.
   1. Description: Low VOC primer which imparts an aggressive, high tack finish on the treated substrate.
   2. Acceptable Materials:
      a. Carlisle: CCW-702
      b. Grace: Perm-A-Barrier WB Primer
      c. Henry Company: HE-574 Blueskin LVC Adhesive

D. Detailing Compound: Joint filler for exterior sheathing joints greater than 1/16 inch (1.59 mm) in width.
   1. Description: Single or multi-component sealant with ±25% movement capability.
   2. Acceptable Materials:
      a. Carlisle: CCW-201 (Multi-component polyurethane)
      b. Grace: Procor, Acrylic Sealer
      c. Henry Company: HE925 BES (Single Component silyl-terminated polyether polymer)

E. Joint Tape: Taping of sheathing board joints greater than ¼ inch.
   1. Description: Self-adhered tape.
   2. Acceptable Materials:

a. Carlisle: AB-151 Scrim, 4 inches (101.6 mm) wide.
b. Grace: Fibatape Cement Board Tape, 3 inches (76.2 mm) wide.
c. Henry Company: Henry #183 Reinforced Mesh, 3 inches (76.2 mm) wide.

F. Sealants: For sealing penetrations and terminations of membrane.
1. Description: Single component liquid mastic, single component silyl-terminated polyether polymer (STPe) sealant complying with ASTM C920, Type S, Grade NS, Class 25 or neutral cure, single component silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25 or Class 100/50.
2. Acceptable Materials:
a. Carlisle: CCW LM-800XL – Liquid Mastic
b. Grace: Bituthene Liquid Membrane
c. Henry Company: HE 925 BES Sealant – STPe
d. Dow Corning: Dow Corning 758 Silicone Weather Barrier Sealant – Alternative to proprietary product for Carlisle, Grace, and Henry pending approval of Manufacturer.

G. Insulation Adhesive: Continuous cavity insulation to be attached to air barrier by adhesive method only. Ahesive used to attach continuous insulation must be recommended and approved by both the Manufacturer of the Air Barrier system and the Manufacturer of the cavity insulation.

H. Perimeter Flashing: At all opaque wall assemblies with cavity or hidden drainage system design for containment of all liquid water and control of air flow at openings in the opaque wall assembly.
1. Stainless Steel Flashing: To comply with ASTM A666, latest edition, Type 304, dead soft stainless steel. Minimum 20 gauge with No. 4 finish.
a. All exposed edges to be hemmed.
b. All splices to be fully encapsulated in sealed splice sleeves designed to accommodate thermal expansion and contraction of metal, structural movements, including vertical liveload deflection, if applicable and remain air and water tight. Splice must be designed to provide continuity between opaque wall assembly air barrier and exterior weather seal at opening.
c. All flashing joints at corners of opening to lapped and sealed to prevent liquid water and air flow to interior. Metal joint seal in corners must be designed to provide continuity between exterior weather seal at opening and air barrier system behind exterior opaque wall covering.
2. Aluminum Flashing: To comply with ASTM B209/B209M, latest edition, 3005 alloy, H12 or H14 temper. Minimum 0.040 inch (1.02 mm) thick with finish to be selected by Architect.
a. All exposed edges to be hemmed.
b. All splices to be fully encapsulated in sealed splice sleeves designed to accommodate thermal exposing and contraction of metal, structural movements, including vertical liveload deflection, if applicable and remain air and water tight. Splice must be designed to provide continuity between opaque wall assembly air barrier and exterior weather seal at opening.
c. All flashing joints at corners of opening to be lapped and sealed to prevent liquid water and air flow to interior. Metal joint seal in corners must be designed to provide continuity between exterior weather seal at opening and air barrier system behind exterior opaque wall covering.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Installer shall examine conditions of substrate and other conditions under which this work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected.

B. Surface Conditions: Before applying air barrier materials, ensure substrates are fully cured, smooth, clean, dry and free from high spots, depression, voids, loose and foreign particles and other deterrents to adhesion.

C. Verify concrete surfaces have cured for time period recommended by air barrier manufacturer, free from release agents, concrete curing agents and other contaminates.

D. Verify masonry joints are struck flush and filled with mortar.

E. Verify that moisture levels in concrete and masonry do not exceed those recommended by manufacturer of air barrier membrane for successful application just prior to installation of fluid-applied air barrier material.

F. Verify all exterior sheathing has been installed correctly to the support framing with correct spacing of attachment screws, as recommended by sheathing manufacturer for anticipated positive and negative design loads and that all exterior sheathing faces are clean, dry and intact with damage or delaminations exposing inner core.

G. Verify that all substrate control and expansion joints are installed and correctly sized to accommodate all anticipated structural movements, including vertical liveload deflection and seismic movements as applicable.

3.02 PREPARATION

A. Refer to Manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, lose aggregate and sharp protrusion. Remove contaminants such as grease, oil, form release agents and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to Manufacturer of the fluid-applied air barrier system.

B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws. Pre-treat all board joints with 3 inch to 4 inch (75 mm to 100 mm) wide, reinforced self-adhesive tape of fiberglass mesh style wallboard tape. Gaps greater than ¼ inch 0.24 inch (6 mm) should be filled with approved sealant, allowing sufficient time to fully cure before application of the tape and fluid applied air barrier.

C. Masonry Substrates: Apply air barrier over concrete block and brick with smooth flush mortar joints. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.

D. Pre-treat over-driven screws and abandoned screw holes as recommended by air membrane manufacturer. If screw misses stud, leave in do not remove.

E. Related Materials: Treat construction joints, interface with adjacent materials and install flashing as indicated on the Contractor drawings and on approved Installer shop drawings.

3.03 INTERFACE WITH ADJACENT WORK

A. Commencement of Work: Commence work once air barrier substrates are adequately protected from weather and will remain protected during remainder of installation.

B. Sequencing of Work: Coordinate sequencing of work with work of other sections that are adjacent to air barrier system to ensure that flashings and transitions materials can be properly installed.

C. Subsequent Work: Coordinate work with work of other sections installed subsequent to air barrier system to ensure complete inspection of installed air barrier membrane and sealing of membrane penetrations necessitated by subsequent work.

3.04 INSTALLATION

A. General: Prepare substrates and install air barrier system components in accordance with air barrier manufacturer's written instructions and project specific recommendations.

B. Application of Fluid Applied Membrane:

1. Spray apply a continuous uniform film at minimum wet film thickness recommended by manufacturer using multiple, overlapping passes.

2. When spraying use a cross-hatching technique (alternating horizontal and vertical passes) to ensure even thickness and coverage.
3. When spraying use high pressure, multi-component, airless spray equipment approved by material manufacturer.
4. Periodically check wet film thickness of installed membrane during installation to ensure compliance with Manufacturer's recommendations.
5. Carry membrane into any openings a minimum of 3 inches (76.2 mm).
6. Seal all penetrations as work progresses.

C. Application of Accessory Materials:
1. Install self-adhering transition membrane strips and accessory materials to installed fluid-applied air barrier membrane or prior to fluid-applied air barrier membrane in accordance with manufacturer's recommendations for maximum performance and adhesion. Comply with recommendations on treatment of rough openings.
2. Connect and seal self-adhered membrane material to adjacent components of building air barrier system, including but not limited to:
   a. Roof membrane system
   b. Below grade or above grade waterproofing system
   c. Perimeter metal flashings at openings or metal flashings used to bridge between incompatible adjacent materials.
3. Penetrations: Seal around penetrations in accordance with air barrier manufacturer's written instructions using approved sealant.
4. Self-adhered Flashing Edges: All exposed cut edges of flashing to be rolled flat to sheathing / fluid-applied air barrier face and sealed in accordance with air barrier manufacturer's written instructions.
5. Through-Wall Flashing: Seal top of through-wall flashing to air barrier membrane as recommended by air barrier manufacturer for type of flashing used. Where self-adhered membrane through-wall flashing is installed over the top of the fluid-applied membrane, install a continuous metal termination bar over the sealed exposed top edge as secondary seal for the through-wall flashing. Seal termination bar to the face of the fluid-applied membrane.
6. Perimeter Metal Flashing Adjacent to Primary Weather Seal: After openings have been wrapped with fluid-applied air barrier system install metal flashing into opening starting with:
   a. Sill Flashing: Configure as indicated on Contract drawings. Length should be minimum 6 inches (152.4 mm) longer than rough opening for 3 inch (76.2 mm) turned up end dam against each jamb substrate. Ends of flashing to be notched and bent up to create end dam.
   b. Jamb Flashing: Configure as indicated on Contract drawings. Length should be equal to vertical rough opening.
   c. Head Flashing: Configure as indicated on Contract drawings. Length should be minimum 6 inches (152.4 mm) longer than rough opening for 3 inch (76.2 mm) down-turned leg at each jamb. Ends of flashing to be notched and bent down over top of jamb flashing to encapsulate exposed top edge.
   d. Just prior to installing metal flashing, run a continuous bead of compatible sealant to installed air barrier system along the outermost corner of opening and set metal flashing into sealant bead.
   e. Sequence of installation starts at sill, then jambs, and finally head flashing. There should be no gaps in metal flashing at the corners of opening, only tight metal to metal joints unless structural movement is to be accommodated at head of opening. In the event this is to occur, follow installation sequence as indicated on contract documents. Otherwise, jamb flashing should be set over top of end dam of sill flashing so only metal to metal joint is visible at the opening side. All metal flashing edges that will be covered by the adjacent metal flashing should be encapsulated in a

bead of silicone just prior to installing the adjacent flashing over it. Toll excess sealant to adjacent metal surfaces.

f. Metal flashing to be joined to air barrier on the cavity side of the installation with the self-adhered transition membrane. All laps in membrane to be in the direction of drainage. All exposed edges of membrane to be sealed at air barrier and metal flashing with silicone sealant. Seal or cover with membrane any holes in metal flashing corners on the cavity side of the flashing.

g. Where metal flashing splices cannot be avoided, they are to be designed to accommodate thermal expansion and contraction of metal, anticipated structural movement and to be encapsulated in splice sleeve for an air and watertight assembly. Splice sleeve to extend into opening past the primary weather seal and to wrap the outermost edge of metal and return to the self-adhered transition membrane on the cavity side of the installation. All exposed edges to be encapsulated in sealant. Splices in metal are to be minimized.

h. Install and tool fillet beads of silicone over the metal to metal joints in corners of opening to encapsulate the exposed metal joints.

D. Leave membrane air barrier exposed until tested and inspected by Owner's testing agency and approved by Architect.

3.05 FIELD INSPECTION AND TESTING

A. Testing Agency: General Contractor shall engage a qualified testing agency with direct oversight by an engineer licensed in the State of Texas to perform a forensic inspection of the product, assembly and performance. Testing and documentation of air barrier installation shall be performed prior to concealment.

1. Inspection: Air barrier system materials, accessories and installation are subject to inspection for compliance with specified requirements, including:

a. Continuous structural support of air barrier system has been provided.

b. Compatibility of materials within air barrier system and with adjacent materials.

c. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions and mortar droppings. Moisture level of surfaces are within limits set by Manufacturer for optimal installation.

d. Exterior sheathing exposed surfaces are smooth, clean dry and intact with no visible damage with all joints sealed and/or taped.

e. All required penetrations through air barrier system, including those required under different scope of work, are in place in exterior wall surface and ready for membrane application.

f. Site conditions for application temperature and dryness of substrates have been maintained for time period set by Manufacturer for optimal installation.

g. Surfaces have been primed, if applicable.

h. Continuity of air barrier system has been achieved throughout the opaque wall area with no gaps or holes.

i. Wet and dry film thickness of fluid-applied membrane complies with Manufacturer's recommended minimum thickness.

j. Connections between assemblies (metal flashing at openings, roof membrane, waterproofing, and weather seals wit air barrier system) are in compliance with approved shop drawings requirements and that continuity of seal has been maintained.

k. Laps in self-adhered transition membrane strips and through-wall flashing membranes have complied with minimum requirements set by Manufacturer and have been shingled in the correct direction, with no fishmouths.

l. All self-adhered membranes have been firmly adhered to substrate and all exposed cut edges have been encapsulated with Manufacturer approved sealant. Sealant to be tooled to membrane surfaces to ensure adhesion.

m. Transition at changes in direction and structural support at gaps have been provided and all anticipated movements accommodated.
n. All penetrations have been sealed in accordance with approved shop drawings and Manufacturer's recommendations.
o. Maximum exposure time of materials to UV deterioration has not been exceeded. Those materials which exceed maximum exposure time will have to be replaced or recovered in accordance with Manufacturer's written recommendations.

2. Field Testing of air barrier assembly to be conducted just to prior installation of exterior wall covering and include exterior sheathing joints, transitions, penetrations, openings, and exterior wall covering anchorage devices that penetrate air barrier if possible. If openings are included completed fixed fenestration frames and weather seals are to be installed prior to test for water tight assembly. No interior finishes or insulation should be installed for full visibility of inboard side of support substrate. Test chamber to span from slab to slab vertically and at least 10 feet (304.8 cm) wide. Field testing to include:
   a. Air Leakage: Tested in accordance with ASTM E783, latest edition. Maximum allowable leakage for the air barrier assembly to be 0.04 cfm/ft2 (0.2 L/(s·m2)) at a static pressure differential of 1.57 psf (75 Pa).
   b. Water Penetration: Tested in accordance with ASTM E1105 – Procedure A, latest edition at a uniform static pressure differential of 10psf (479 Pa). No water visible on any interior surfaces allowed including structure, support studs or inboard surface of exterior sheathing.

B. Written reports documenting observations made during inspections and results of field testing to be submitted to Owner, Architect, and Contractor within five working days of the inspection and performance of field testing.

C. A minimum of three inspections and field tests are to be conducted during the installation of the air barrier assembly. Out of sequence work is to be scheduled in test areas so as not to delay field testing schedule. Field testing to be conducted at 10%, 50%, and 80% completion of the installation. Depending upon results of initial inspections and field tests Owner reserves the right to require increased frequency of inspection visits and field testing.

D. Correct deficient applications not passing tests and inspections, make necessary repairs, and retest as required to demonstrate compliance with performance requirements at no additional cost to Owner.

3.06 PROTECTION AND CLEANING

A. Remove any masking materials after installation. Clean any stains on materials that would be exposed in the completed work using procedures as recommended by manufacturer.

B. Air barrier assemblies not suitable for permanent exposure should be protected from the effects of sunlight.

C. Schedule work to ensure that the air barrier system is covered as soon as possible after installation. Protect air barrier system from damage during subsequent operations. If the air barrier system cannot be covered within time stipulated by manufacturer after installation, apply temporary UV protection such as dark plastic sheet or tarpaulins.

END OF SECTION 07 27 27

SECTION 07 41 13
METAL ROOF PANELS - STANDARD

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

1.02 SUMMARY

A. Furnish and install standing seam roof.

1.03 SUBMITTALS

A. Submit product data and shop drawings. Show sections and details of roof with substrate and structure, eave flashing and roof edge.

B. Submit samples of specified color for verification.

C. Submit a small scale roof plan identifying corner and perimeter areas and the increased fastening pattern as per manufacturer's instructions at these locations.

D. Submit wind uplift pressure criteria utilizing ASCE 7.

1.04 REFERENCES

A. American Society for Testing and Materials.

B. Factory Mutual Global.

C. National Roofing Contractors Association.

D. Sheet Metal and Air Conditioning Contractors Association.

E. American National Standards Institute/Single Ply Roofing Institute (ANSI/SPRI).

F. Manufacturer's Printed Instructions.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturer (basis of design):
   1. Berridge "Zee Lock Double Lock Seamed" 24 GA or approved equal.
   2. Other Approved Manufacturers:
      a. MBCI "SuperLok"
      b. Alliance
      c. PAC-CLAD
   3. All materials of the same type shall be products of the same manufacturer.
   4. All prefinished sheet metal materials exposed to view concurrently shall be from the same prefinished coil stock finish run, batch or lot.
   5. All trim and accessories shall be furnished by the same manufacturer.

2.02 MATERIALS

A. Integral Standing Seam Roof System: Meet Code Wind Load for UL Class and secure using FM LPS 1-31 requirements. Design for wind uplift pressure criteria utilizing ASCE 7.
   1. Material: Galvalume, 24 gauge unless otherwise indicated.
   2. Finishes:
      a. Finished Metal shall be Coil-coated 20-year warranty fluoropolymer finish containing at least 70% Kynar 500 of at least 1 mil (0.0254 mm) total dry film thickness. Color as selected by Architect from manufacturer's full line of available colors and textures.
      b. Unfinished Metal shall be Grade C Galvalume ASTM A792-86, AZ 55, "Satin Finish".
   3. Panels: Factory-formed; striated, width of 16 inches (406.4 mm), with minimum 2-inch high continuous interlocking seam mechanically roll formed in field.
   4. Fabricate panels' full length from ridge to eave.

2.03 METAL ROOF ACCESSORIES

A. Provide additional and accessory products by the same manufacturer, where possible. Provide only products acceptable to the manufacturer of the roof panels.

B. Panel Clip Screw for Fastening to Purlins: Manufacturer's standard.

C. Roof Panel Clips: Underwriters Laboratory Class 105 and Factory Mutual I-105; Underwriters Laboratories Classified and bearing UL Label; as recommended and supplied by panel manufacturer.

D. Primer: Asphalt Type, ASTM D41.

E. Underlayment Fastener: Stainless steel nails, ring shank with plastic caps.

F. Metal Closures and Trim: Prefinished aluminum sheet; match roof panels.

G. Accessory Screws: Stainless steel Size and type as provided by panel manufacturer for each use.

H. Pop-Rivets: Stainless steel, series 42 or 44, as required for the application.

I. Sealant: Color-coordinate primer-less urethane, or high-grade, non-drying butyl, as supplied by panel manufacturer.

J. Sealant Tape: 1/8 inch (3.18 mm) x ¾ inch butyl tape as supplied by panel manufacturer.

K. Waterproofing Membrane Underlay: Tamko – Metal and Tile Underlayment; Grace – Vycor 40.

PART 3 EXECUTION

3.01 METAL ROOF FLASHING

A. Install eave flashing before panel installation. Secure all drip and rake edges at 6" o.c. with two staggered rows.

B. Install manufacturer-approved flashing materials at eaves. Do not use "J-clips".

3.02 ROOF PANELS

A. Follow manufacturer's instructions and recommendations to produce a weathertight installation.

B. Install panels in continuous lengths without end-to-end seams.

C. Seam clips: Install at 16 inches (406.4 mm) o.c., or as otherwise recommended by the system manufacturer, whichever is more stringent.

D. Provide for ½-inch movement at upslope terminations and at least 1-inch clearance around penetrations. Hem bottom panel edges 1-inch and hook onto metal edge. Do not use "J-clip" flashing details.

E. Trim: Install in complete assemblies along with the light metal coping cap at brick walls; include flashings.

F. Carefully apply concealed sealant beads and sealant tape at all penetrations, intersections and other locations (but not at standing seams) necessary for waterproof installation.

3.03 WARRANTY

A. Provide 20-year weather-tightness warranty from Manufacturer.
   1. Coordinate with manufacturer for all onsite inspections that may be required per the terms of the warranty.

B. Provide 2-year installation workmanship warranty.
   1. Coordinate with manufacturer for all onsite inspections that may be required per the terms of the warranty.

3.04 CLEANING AND PROTECTION

A. Clean surfaces promptly after installation.

B. Use methods and materials for cleaning recommended by manufacturer. Follow manufacturer's instructions and recommendations so methods and materials do not void finish warranty.

C. Protect work so roofing will be undamaged at Final Completion.

D. Replace damage materials.

END OF SECTION 07 41 13

SECTION 07 42 13
ALL WEATHER INSULATED PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory foamed-in-place insulated metal panels with concealed fastener metal roof panels and related trim and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM C1363 - Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus; 2024.

C. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.

D. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2023.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

F. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2025.

G. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2025.

H. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2024).

I. ASTM E1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems; 2016 (Reapproved 2022).

J. FM 4471 - Examination Standard for Class 1 Panel Roofs; 2025.

K. FM 4880 - Examination Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials; 2022.

L. FM 4882 - Examination Standard for Class 1 Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies; 2021.

M. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

N. ISO 14001 - Environmental Management Systems — Requirements with Guidance for Use; 2015, with Amendment (2024).

O. ISO 45001 - Occupational Health and Safety Management Systems - Requirements with Guidance for Use; 2018, with Amendment (2024).

1.03 RELATED SECTIONS

A. Division 07 “Thermal Insulation” for insulation of roof and wall assemblies

B. Division 07 “Roofing and Siding Panels” for insulated metal panels

C. Division 07 “Metal Roof and Wall Panels” for factory-formed metal wall or roof panels

D. Division 07 Section "Sheet Metal Flashing and Trim" for flashings and trim

1.04 REFERENCES

A. Design and Test Standards: Refer to the following organizational publications for design and test standards referenced within specification
   1. American Society of Civil Engineers (ASCE)
   2. International Building Code (IBC)
   3. ASTM International (ASTM)

4. FM Global and FM Approvals (FM)
5. Underwriters Laboratories (UL)
6. Underwriters Laboratories of Canada (CAN/ULC)

1.05 DESIGN CRITERIA

A. General: The insulated metal roof panels shall be metal faced foam core sandwich panels utilizing InnovaCELL™ Technology produced on a continuous process manufacturing line under strict quality control and must be independently audited by a recognized audit facility/testing lab. The roof panel system (panel thickness, gauge, spans, connections) shall be designed to resist specified wind loads with a deflection not to exceed L/240, thermally induced movement, and exposure to weather without failure.

1.06 SUBMITTALS

A. Product Data: Manufacturer's data sheets for each product to be provided.

B. Detail Drawings: Contractor shall furnish detailed drawings showing location and profile of insulated metal panels, as well as location and shape of formed metal flashings, the location and type of sealants and fasteners and design information.
   1. Drawing of panel profile, thickness, gauge
   2. Design information
   3. Insulated Metal Panel Fastening schedule
   4. Samples: Provide for each product specified.

C. Maintenance Data: Refer to AWIP's latest published documents on www.awipanels.com.

D. Warranty: Provide manufacturer's current Warranty specimen.
   1. Submit manufacturer's written two (2) year limited warranty providing materials to be free from defects in material and workmanship from the date of production excluding coil coatings and paint finishes that are covered under a separate warranty.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Metal roof panels shall be erected by an experienced metal panel contractor in accordance with the approved drawings, specifications, and installation instructions.

B. Manufacturer Qualifications: Qualified manufacturer that has tests and approvals for panel system identical to that used for this Project.
   1. Approved manufactured listed in this Section with minimum ten years experience in manufacturing of insulated metal panels
   2. Approved manufacturer certified to ISO 37301 (Compliance), ISO 9001 (Quality), ISO 14001 (Environmental), ISO 45001 (Occupational Health and Safety), IAS 473 (Cold Form Steel Components)

C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to IAS Accreditation or equal.Retain test report and moisture survey subparagraphs below for all re-roof and re-cover applications.

D. Source Limitations: Obtain all components, including insulated metal panels, fasteners, trim and other accessories from a single source manufacturer Warrantying the panel system.

E. Substitutions: This specification is written with the SR2 panels with InnovaCELL™ Technology as the basis of acceptable design, quality and performance. Requests for substitutions must be submitted in writing no less than 14 days prior to bid.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during delivery, storage and handling to prevent staining, denting, deterioration of components or other damage. Product panels and trim bundles during shipping.

1. Deliver insulated metal roof panels in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
2. Store in accordance with Manufacturer's written instructions.
3. Cover insulated metal panels with temporary shelter and from direct sunlight until all components are installed.

1.09 WARRANTY

1. Manufacturer's Warranty: Submit manufacturer's written two (2) year limited warranty providing materials to be free from defects in material and workmanship from the date of production excluding coil coatings and paint finishes that are covered under a separate warranty.
2. Paint Finish Warranty: Submit Manufacturer's limited warranty on the exterior paint finish for adhesion to the metal substrate and on the exterior paint finish for chalk, fade and cracking.
   a. Fluoropolymer (PVDF or FEVE) Two-Coat System:
      1) Chalk in excess of a numerical rating of eight (8) when measured in accordance with the standard procedures outlined in ASTM D4214
      2) Fade or change in color in excess of five (5) E units when calculated in accordance with ASTM D2244. The color change is to be measured on exposed painted surface cleaned of surface soils and oxidation.
      3) Failure of adhesion, peeling, checking or cracking.
      4) Warranty Period: Twenty (20) years from the date of installation of the panels.
3. Installer's Warranty: The installation contractor shall issue a separate warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis of Design Manufacturer: All Weather Insulated Panels, 929 Aldridge Rd, Vacaville, CA 95688, Telephone: 888-970-AWIP, Email: sales@awipanels.com; Website: www.awipanels.com

2.02 PERFORMANCE REQUIREMENTS

A. General: Provide metal panel system meeting performance requirements as determined by specification.

B. Structural Performance: Provide metal panel assemblies capable of withstanding positive and negative loads and stresses as determined by ASTM E1592 Structural Test with the standard deflection criteria to be L/240.
   1. Wind Loads: Determine wind loads based on applicable building code, wind speed, importance factor, risk category, exposure category and internal pressure coefficient.
   2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of L/240 (exterior roof).
   3. The panels shall be FM Approved as a Class 1 Roof Construction in accordance with FM 4471

C. Thermal Performance: Provide insulated metal panel assemblies meeting the specified thermal performance
   1. Foam thermal insulation value as determined by ASTM C518 steady state thermal transmission
      a. a. Nominal R-value of 8.0 hr·ft2·°F/Btu per inch thickness at 75°F mean temperature and 8.5 hr·ft2·°F/Btu per inch at 35°F mean temperature
         1) b. Nominal K-factor of 0.125 Btu/hr·ft2·°F per inch thickness at 75°F mean temperature and 0.117 Btu/hr·ft2·°F per inch at 35°F mean temperature

2. Panel system thermal performance value as determined by ASTM C1363 thermal transmittance evaluated with at least two panel joints
    1) 3.25 inch (82.55 mm) thick: U-factor of 0.043 Btu/hr·ft2·°F at 75°F mean temperature and 0.039 Btu/hr·ft2·°F per inch at 35°F mean temperature
    2) 4 inch (101.6 mm) thick: U-factor of 0.035 Btu/hr·ft2·°F at 75°F mean temperature and 0.032 Btu/hr·ft2·°F per inch at 35°F mean temperature
    3) 5 inch (127 mm) thick: U-factor of 0.029 Btu/hr·ft2·°F at 75°F mean temperature and 0.026 Btu/hr·ft2·°F per inch at 35°F mean temperature
    4) 6 inch (152.4 mm) thick: U-factor of 0.025 Btu/hr·ft2·°F at 75°F mean temperature and 0.022 Btu/hr·ft2·°F per inch at 35°F mean temperature

D. Fire Performance Characteristics: Provide metal panel systems with the following fire-test characteristics determined by applicable test standard
1. Surface-Burning Characteristics: The foam core shall be tested per ASTM E84. The core shall have:
    a. Flame Spread Index: 25 or less
    b. Smoke Developed Index: 450 or less
2. Exterior Fire Exposure Test: The roof panels shall be tested as a Class A material per ASTM E108.
3. Room Test: The panel assembly shall have a FM Approvals Class 1 rating for wall and ceiling construction in accordance to the full scale FM 4880 test program with no height restriction.
4. Smoke Sensitive Structures: The panels shall be FM Approved as a Class 1 Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies as tested in accordance with FM 4882
5. IBC Chapter 26: Metal panel assemblies meeting the above test methods shall meet the requirements of the International Building Code on Foam Plastics.

E. Air Infiltration: Provide metal panel assemblies tested per ASTM E1680
1. Air leakage shall not exceed .01 cfm/ft2 at a static air pressure differential of 12 PSF.

F. Water Penetration: Provide metal panel assemblies tested per ASTM E1646
1. Water penetration shall not be observed at the panel joint at a static pressure differential of 20 PSF.

2.03 INSULATED METAL ROOF PANELS

1. The insulated metal roof panel shall have a side joint with a 2 inch (50.8 mm) trapezoidal standing seam rib utilizing a continuous bead of butyl sealant applied to the adjacent seam overlap. The panels shall be fastened with ¼-14 hex head sealing washered fasteners installed through pre-punched thermally-broken SR series panel clips. The clip assembly shall positively lock the face and liner sheet of the panel to the structural supports and provide positive resistance to negative wind loads. An additional minimum 1/4 inch (6.35 mm) continuous bead of approved non-skinning butyl gun grade sealant shall be applied at the liner side edge of the roof panel joint prior to engagement as shown on the panel shop/erection drawings
    a. Basis of Design: All Weather Insulated Panels, SR2 with InnovaCELL™ Technology
2. Provide insulated metal panel with minimum R Value per ASTM C518: 32
3. Provide insulated metal panel with maximum U Factor per ASTM C1363: insert U Factor
4. Provide insulated metal panel with minimum thickness: 5’’
5. The insulated metal panel shall be 40’’ wide with standing seam trapezoidal rib.
6. Provide exterior metal substrate. G90 galvanized coated steel conforming to ASTM A653 or AZ50 aluminum-zinc (Galvalume) alloy coated steel, conforming to ASTM A792, minimum grade 33, prepainted by the coil-coating process per ASTM A755
    a. The exterior profile shall be non-embossed with a standing seam trapezoidal rib and lightly planked mesa ribs
    b. Facing Thickness: 22 ga
    c. Finish: Fluoropolymer (PVDF or FEVE) Two-Coat System

1) Thickness: 1.0 mil (0.0254 mm) dry film thickness
d. Color: As Selected by Architect from manufacturer's standard colors

7. Provide interior metal substrate. G90 galvanized coated steel conforming to ASTM A653 or AZ50 aluminum-zinc (Galvalume) alloy coated steel, conforming to ASTM A792, minimum grade 33, prepainted by the coil-coating process per ASTM A755
   a. The interior profile shall be standard embossed with lightly planked mesa ribs on 2.22'' centers
   b. Facing Thickness: 22 ga
   c. Finish: Fluoropolymer (PVDF or FEVE) Two-Coat System
      1) Thickness: 1.0 mil (0.0254 mm) dry film thickness
   d. Color: Peppercorn Grey
8. The InnovaCELL™ foam core shall meet or exceed the following physical properties:
   a. Compressive Strength (ASTM D1621): 17.5 PSI
   b. Density, in-place (ASTM D1622): 2.00 – 2.50 PCF
   c. Tensile Adhesion (ASTM D1623): 13.5 PSI
   d. Tensile Strength (ASTM C297): 16 PSI
   e. Dimensional Stability (ASTM D2126): 14 day aged < 0.5% change at -20 degree F, < 1.0% change at 158 degree F dry heat, < 1.0% change at 158 degree F humid heat
9. Panels not meeting these testing and performance criteria are not permitted to be used for this metal roof panel application.

2.04 METAL ROOF PANEL ACCESSORIES

A. Flashings: The insulated metal panel manufacturer shall furnish either the formed metal flashings or the flat stock in the same gauge, color, and paint finish system as the panel facings

B. Panel Fasteners: Self-drilling or self-tapping screws and other acceptable fasteners recommended by panel manufacturer. Where exposed fasteners cannot be avoided, supply corrosion-resistant fasteners with heads matching color of metal panels by factor-applied coating, with weather tight sealing washers.

C. Sealant: Provide non-skinning butyl sealant and/or butyl tape sealant in accordance to manufacturer's standards

D. Panel Seamer: Panel seamer specifically designed to be used with the SR2 panel shall be ordered through DI Seamers at www.awipseamers.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine metal panel system substrate with Installer. Inspect for erection tolerances and other conditions that would adversely affect installation of metal panels.
   1. The contractor or installer shall examine the alignment of the steel supports before installing the metal roof panel system. The steel shall be aligned to the tolerances established in the AISC code of standard practice, Section 8 and the supplemental modification control Section 7.11.
   2. Panel support tolerances:
      a. Maximum deviation of steel alignment shall be limited to -0 to 3/16'' from the control with a 1/8'' maximum change in deviation for any member of any 10'-0'' run of panel.
   3. The erector shall not proceed with installation if steel support is not within the specified tolerances
   4. The face of all structural members to which the panels are attached must be in the same vertical plane, flat and free of obstructions, such as weld marks, bolts or rivet heads. In no case shall roof panels be fastened directly to structural framing members installed in the same direction of the roof panels.

3.02 METAL PANEL INSTALLATION

A. Manufacturer shall provide panel contractor with written instructions for recommended product storage and handling as well as standard installation procedures.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform tests and inspections and to prepare test reports.

B. A roof inspection is required by All Weather Insulated Panels before issuance of Warranty.

3.04 PROTECTION AND CLEANING

A. Remove temporary protective films in accordance with manufacturer's written instructions. Do not leave in direct sunlight.

B. Clean finished surfaces as recommended by metal panel manufacturer.

C. Repair or replace any damaged or defective panels after determination of responsibility.

END OF SECTION



SECTION 07 42 13
METAL WALL PANELS - STANDARD

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exposed fastener metal wall panels, with related metal trim and accessories.

1.02 RELATED REQUIREMENTS

A. Division 05 Section “Structural Steel Framing” for structural steel framing supporting metal panels.

B. Division 05 Section “Cold-Formed Metal Framing” for cold-formed metal framing supporting metal panels.

C. Division 07 Section “Thermal Insulation” for thermal insulation installed under metal panels.

D. Division 07 Section “Air Barriers” for air barriers within wall assembly and adjacent to wall assembly.

E. Division 07 Section “Metal Soffit Panels” for factory-formed metal roof panels.

F. Division 07 Section “Sheet Metal Flashing and Trim” for sheet metal flashing items in addition to items specified in this Section.

G. Division 13 Section “Metal Building Systems” for steel framing supporting metal panels.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025a.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2024.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

G. ASTM D1003 - Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics; 2021.

H. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.

I. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2023.

J. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2024).

K. ASTM E1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems; 2016 (Reapproved 2022).

L. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; 2024, with Editorial Revision (2025).

1.04 REFERENCES

A. American Architectural Manufacturer’s Association (AAMA): www.aamanet.org:
   1. AAMA 621 – Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) & Zinc-Aluminum Coated Steel Substrates.

2. AAMA 809.2 – Voluntary Specification Non-Drying Sealants.

B. American Society of Civil Engineers (ASCE): www.asce.org/codes-standards:
   1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures.

C. ASTM International (ASTM): www.astm.org:
   1. ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A 755 – Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   3. ASTM A792/A792M – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   4. ASTM C645 – Specification for Nonstructural Steel Framing Members.
   5. ASTM C754 – Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
   6. ASTM C920 – Specification for Elastomeric Joint Sealants.
   7. ASTM D1003 – Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics.
   8. ASTM D2244 – Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
   9. ASTM D4214 – Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
   10. ASTM E 283 – Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   11. ASTM E 311 – Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

D. International Accreditation Service (IAS):
   1. IAS AC472 – Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems, Part B.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Prior to erection of framing, conduct preinstallation meeting at site attended by Owner, Architect, manufacturer's technical representative, inspection agency and related trade contractors.
   1. Coordinate building framing in relation to metal panel system.
   2. Coordinate openings and penetrations of metal panel system.

1.06 QUALITY ASSURANCE

A. Manufacturer/Source: Provide metal panel assembly and accessories from a single manufacturer providing fixed-base roll forming, and accredited under IAS AC472 Part B.

B. Manufacturer Qualifications: Approved manufacturer listed in this Section with minimum five years experience in manufacture of similar products in successful use in similar applications.
   1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
      a. Product data, including certified independent test data indicating compliance with requirements.
      b. Samples of each component.
      c. Sample submittal from similar project.
      d. Project References: Minimum of five installations not less than five years old, with Owner and Architect contact information.
      e. Sample warranty.
      f. IAS AC472 certificate.
   2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
   3. Approved manufacturers must meet separate requirements of Submittals Article.

C. Installer Qualifications: Experienced Installer with minimum of five years of experience with successfully completed projects of a similar nature and scope.
   1. Installer's Field Supervisor: Experienced mechanic, able to communicate with Owner, Architect, and installers, supervising work on site whenever work is underway.

1.07 ACTION SUBMITTALS

A. Project Data: Manufacturer's data sheets for specified products. Include data indicating compliance with performance requirements.

B. Shop Drawings: Show layouts of metal panels. Include details of each condition of installation, panel profiles, and attachment to building. Provide details at a minimum scale 1-1/2-inch per foot of edge conditions, joints, fastener and sealant placement, flashings, openings, penetrations, and special details. Make distinctions between factory and field assembled work.
   1. Indicate points of supporting structure that must coordinate with metal panel system installation.
   2. Include data indicating compliance with performance requirements.

C. Samples for Initial Selection: For each exposed product specified including sealants. Provide representative color charts of manufacturer's full range of colors.

D. Samples for Verification: Provide 12-inch long section of each metal panel profile. Provide color chip verifying color selection.

1.08 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Indicating compliance of products with requirements.

B. Qualification Information: For Installer firm and Installer's field supervisor.

C. IAS Accreditation Certificate: Indicating that manufacturer is accredited under provisions of IAS AC472.

D. Manufacturer's Warranty: Sample copy of manufacturer's standard warranty.

1.09 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy manufacturer's standard warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protect products of metal panel system during shipping, handling, and storage to prevent staining, denting, deterioration of compounds or other damage. Protect panels and trim bundles during shipping.
   1. Deliver, unload, store, and erect metal panel system and accessory items without misshaping panels or exposing panels to surface damage from weather or construction operations.
   2. Store in accordance with Manufacturer's written instructions. Provide wood collars for stacking and handling in the field.

1.11 WARRANTY

A. Special Manufacturer's Warranty: On manufacturer's standard form, in which manufacturer agrees to repair or replace metal panel assemblies that fail in materials and workmanship within one year from date of Substantial Completion.

B. Special Panel Finish Warranty: On Manufacturer's standard form, in which Manufacturer agrees to repair or replace metal panels that evidence deterioration of factory-applied finish within the warranty period, as follows:
   1. Fluoropolymer Two-Coat System:
      a. Basis of Design System: MBCI, Signature 300.
      b. Color fading in excess of 5 Hunter units per ASTM D2244.
      c. Chalking in excess of No. 8 rating per ASTM D4214.
      d. Failure of adhesion, peeling, checking, or cracking.

e. Warranty Period: 40 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis of Design Manufacturer: MBCI Metal Roof and Wall Systems, Division of NCI Group, Inc.; Houston TX. Tel: (877) 733-6224; Email: info@mbci.com; Web: www.mbci.com.
   1. Provide basis of design product, or comparable product approved by Architect prior to bid.

2.02 PERFORMANCE REQUIREMENTS

A. General: Provide metal wall panel system meeting performance requirements as determined by application of specified tests by a qualified testing facility on manufacturer's standard assemblies.

B. Structural Performance: Provide metal panel assemblies capable of withstanding the effects of indicated loads and stresses within limits and under conditions indicated:
   1. Wind Loads: Determine loads based on uniform pressure, importance factor, exposure category, and basic wind speed indicated on drawings:
      a. Wind Negative Pressure: Certify capacity of metal panels by actual testing of proposed assembly.
   2. Deflection Limits: Withstand inward and outward wind-load design pressures in accordance with applicable building code with maximum deflection of 1/120 the span with no evidence of failure.

C. Air Infiltration, ASTM E1680:
   1. Maximum 0.006 cfm/sq. ft. (0.030 L/s per sq. m) at 6.24 lbf/sq. ft. (300 Pa) static-air-pressure difference.

D. Water Penetration, ASTM E1646:
   1. No uncontrolled water penetration at a static pressure of 20 lbf/sq. ft. (958 Pa).

E. Thermal Movements:
   1. Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and construction. Allow for deflection and design for thermal stresses caused by temperature differences from one side of the panel to the other.

2.03 METAL WALL PANELS

A. Large Tapered-Rib-Profile, Exposed Fastener Metal Panels: Structural metal panel consisting of formed metal sheet with trapezoidal major ribs with intermediate stiffening ribs symmetrically placed between major ribs, installed by lapping edges of adjacent panels.
   1. Basis of Design: MBCI, PBR Panel, www.mbci.com/pbr.html.
   2. Coverage Width: 36 inches (914.4 mm).
   3. Major Rib Spacing: 12 inches (304.8 mm) on center.
   4. Rib Height: 1-1/4 inch (32 mm).
   5. Nominal Coated Thickness: 24 gauge.
   6. Panel Surface: Smooth.
   7. Exterior Finish: Fluoropolymer two-coat system.
   8. Color: Almond.
      a. As selected by Architect from manufacturer's standard colors.

2.04 METAL PANEL ACCESSORIES

A. General: Provide complete metal panel assembly incorporating base, corner, and opening trims and miscellaneous flashings, in manufacturer's standard profiles and custom profiles as indicated. Provide required fasteners, closure strips, support plates, and sealants as indicated in manufacturer's written instructions.

B. Flashing and Trim: Match material, thickness, and finish of metal panel face sheet.

C. Panel Fasteners: Self-tapping screws and other acceptable fasteners recommended by metal panel manufacturer.
   1. Exposed Fasteners: Long life fasteners with EPDM or neoprene gaskets, with heads matching color of metal panels by means of factory-applied coating.

D. Joint Sealers: Manufacturer's standard or recommended liquid and preformed sealers and tapes, and as follows:
   1. Tape Sealers: Manufacturer's standard non-curing butyl tape, AAMA 809.2.

E. Steel Sheet Miscellaneous Framing Components: ASTM C645, with ASTM A653/A653M, G60 (Z180) hot-dip galvanized zinc coating.

2.05 FABRICATION

A. General: Provide factory fabricated and finished metal panels and accessories meeting performance requirements, indicated profiles, and structural requirements.

B. Panel Lengths: Form panels in continuous lengths for full length of detailed runs, except where otherwise indicated on approved shop drawings.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions, approved shop drawings, and project drawings. Form from materials matching metal panel substrate and finish.

2.06 FINISHES

A. General: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Fluoropolymer Two-Coat System: 0.2 – 0.3 mil (0.00762 mm) primer with 0.7 – 0.8 mil (0.02032 mm) 70 percent PVDF fluoropolymer color coat, AAMA 621, meeting solar reflectance index requirements.
   1. Basis of Design: MBCI, Signature 300.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine metal panel system substrate and supports with Installer present. Inspect for erection tolerances and other conditions that would adversely affect the installation of metal panel installation.
   1. Inspect metal panel support substrate to determine if support components are installed as indicated on approved shop drawings. Confirm presence of acceptable supports at recommended spacing to match installation requirements of metal panels.
   2. Panel Support Tolerances: Confirm that panel supports are within tolerances acceptable to metal panel system manufacturer but not greater than the following:
      a. ¼ inch 0.24 inch (6 mm) in 20 foot (609.6 cm) in any direction.

B. Correct out-of-tolerance work and other deficient conditions prior to proceeding with metal panel system installation.

3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, girts, furring, and other miscellaneous panel support members according to ASTM C 752 and manufacturer's written instructions.

B. Flashing: Install flashings to cover exposed underlayment per Section 07 62 00 "Sheet Metal Flashing and Trim".

3.03 METAL PANEL INSTALLATION

A. Exposed Fastener Metal Wall Panels: Install weathertight metal panel system in accordance with manufacturer's written instructions, approved shop drawings, and project drawings. Install metal panels in orientation, sizes, and locations indicated, free of waves, warps, buckles, fastening stresses, and distortions. Anchor panels and other components securely in place. Provide for thermal and structural movement.

B. Panel Sealants: Install manufacturer's recommended tape sealant at panel side laps and end laps.

C. Panel Fastening: Attach panels to supports using screws, fasteners, and sealants recommended by manufacturer and indicated on approved shop drawings.
   1. Fasten metal panels to supports at each location indicated on approved shop drawings, with spacing and fasteners recommended by manufacturer.
   2. Provide weatherproof jacks for pipe and conduit penetrating metal panels of types recommended by manufacturer.
   3. Dissimilar Materials: Where elements of metal panel system will come into contact with dissimilar materials, treat faces and edges in contact with dissimilar materials as recommended by manufacturer.

3.04 ACCESSORY INSTALLATION

A. General: Install metal panel trim, flashing, and accessories using recommended fasteners and joint sealers, with positive anchorage to building, and with weather tight mounting. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal panel assembly, including trim, copings, flashing, sealants, closure strips, and similar items.
   2. Comply with details of assemblies utilized to establish compliance with performance requirements and manufacturer's written installation instructions.
   3. Set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently weather resistant.

B. Joint Sealers: Install joint sealers where indicated and where required for weathertight performance of metal panel assemblies, in accordance with manufacturer's written instructions.
   1. Prepare joints and apply sealants per requirements of Division 07 Section "Joint Sealants".

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency acceptable to Architect to perform field tests and inspections and to prepare test reports, as needed.

3.06 CLEANING AND PROTECTION

A. Remove temporary protective films immediately in accordance with metal panel manufacturer's instructions. Clean finished surfaces as recommended by metal panel manufacturer.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION 07 42 13

SECTION 07 42 13.03
METAL WALL & SOFFIT PANELS - PAC-CLAD

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section covers the pre-finished, pre-fabricated Architectural metal wall panel system. All metal trim, accessories, fasteners, insulation and sealants on the drawings as part of this section.

B. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.02 SUMMARY

A. Section Includes:
   1. Factory formed metal wall panels.

B. Related work specified elsewhere.
   1. Metal Roof Deck: Division 5 – Metal Deck Sections.
   2. Wood Framing and Decking: Division 6 Roof Carpentry Section.
   3. Flashing and Trim: Division 7 – Flashing and Sheet Metal.
   4. Coping: Division 7 Roof Specialties and Accessories.
   5. Sealants: Division 7 Joint Sealers Sections.

1.03 DEFINITIONS

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, thermal, and accessories necessary for a complete weathertight system.

1.04 REFERENCE STANDARDS

A. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025a.

B. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.

C. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2023.

1.05 QUALTIY ASSURANCE

A. Petersen Aluminum Corp, Tyler, TX, 800-441-8661 Petersen Aluminum Corp, Pheonix, AZ, 833-750-1935 products establish a minimum of quality required.

B. Manufacturer and erector shall demonstrate experience of a minimum of five (5) years in this type of project.

C. Sheet Metal Industry Standard: Comply with Sheet Metal and Air Conditioning Contractors National Association (SMACNA) Architectural Sheet Metal Manual.

D. Panels shall be factory-produced only. No portable, installer-owner or installer-rented machines will be permitted.

1.06 SUBSTITUTIONS

A. The material, products and equipment specified in this section establish a standard for required function, dimension, appearance and quality to be met by any proposed substitution.

1.07 SYSTEM DESCRIPTION

A. Material to comply with:
   1. ASTM A792/A792M Standard Specification for Sheet Steel, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip process.

1.08 WALL PANEL SYSTEM PERFORMANCE TESTING

A. General Performance: Metal wall panels shall comply with performance requirements without failure due to effective manufacture, fabrication, installation or other defects in construction.

B. Panels to meet:
   1. Metal Wall or Metal Soffit System shall be designed to meet applicable Local Building Code and the Soffit System shall have been tested by the Manufacturer per ASTM E-330 and have the applicable Load Tables published from this Air Bag testing for negative loads.

1.09 WARRANTIES

A. Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finish within specified warranty period.
   1. Exposed Panels Finish – deterioration includes the following:
      a. Color fading more than 5 hunter units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling or failure of a paint to adhere to a bare metal.
   2. Warranty Period: 20 years from the date of substantial completion.

B. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight condition.

1.10 SUBMITTALS

A. Furnish detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may by required for weather-tight installation.

B. Provide finish samples of all colors specified.

C. Shop drawings: Show fabrication and installation layouts of metal wall panels or metal soffit panels, details of edge conditions, panel profiles, corners, anchorages, trim, flashings, closures and accessories, and special details. Distinguish between factory and field-assembled work.

D. Coordination Drawings: Plans, drawn to scale, on which the following are shown and coordinated with each other, based on input from installer of the items involved.

1.11 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instruction and lead time requirements to avoid construction delays.

B. Deliver components, sheet, metal wall panels and other manufactured items so as not to be damaged or deformed. Package metal wall panels for protection during transportation and handling.

C. Unload, store and erect metal wall panels in a manner to prevent bending, warping, twisting and surface damage.

D. Stack metal wall panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness. Do not store metal wall panels in contact with other materials that might cause staining, denting or other surface damage.

E. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.12 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal wall panel work to be performed.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

PART 2 PRODUCTS

2.01 PANEL DESIGN

A. General: Provide factory-formed metal wall panels designed for wall, soffit and fascia applications where a flush or flat appearance is desired. A round interlock leg concealed fastenings system act to improve the flush appearance while providing additional strength.

B. Wall panels shall be Flush Wall with Widths and Reveals as Noted on Drawings.

C. Panels to be produced Smooth – Factory Standard.

D. Forming: Use continuous end rolling method. No end laps on panels. No portable roll forming machines will be permitted on this project, no installer-owned or installer-rented machines will be permitted. It is the intent of the Architect to provide Factory-Manufactured panel systems only for this project.

2.02 ACCPETABLE MANUFACTURERS

A. This project is detailed around the metal wall product of Petersen Aluminum Corp, Tyler, TX, 800-441-8661 Petersen Aluminum Corp, Phoenix, AZ, 833-750-1935 Flush Wall.

B. Equivalent as Approved by Architect during Bidding.

2.03 MATERIALS AND FINISHES

A. Preformed metal panels shall be fabricated of 22 GA and shall be Herr-Voss corrective leveled for flat appearance.

B. Colors shall be as Indicated on Drawings.

C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil (0.02286 mm) over a 0.25 to 0.3 mil (0.00762 mm) prime coat to provide a total dry film thickness of 0.95 to 1.25 mil (0.03175 mm), to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil (0.00635 mm). Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.

D. If Strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.

E. Trim: Trim shall fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet (365.76 cm). Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.

F. Accessories/Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substates. Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the wall panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces, except at designed points of roof panel fixity.

G. Substrate shall be Indicated on Drawings.

H. Underlayment:
   1. As Indicated on Drawings.

I. Sealants:
   1. Provide two-part polysulfide class B non-sag type for vertical and horizontal joints or,
   2. One part polysulfide not containing pitch or phenolic extenders or,
   3. Exterior grade silicone sealant recommended by roofing manufacturer or,
   4. One part non-sag, gun grade exterior type polyurethane recommended by the roofing manufacturer.

2.04 FABRICATION

A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.
   1. Max panel length is 55'.

B. Fabricate components of the system in factory, ready for field assembly.

C. Fabricate components and assemble units to comply with fire performance requirements specified.

D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's instructions.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine alignment of structural steel and related supports, primary and secondary roof framing, solid roof sheathing, prior to installation.

B. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 FASTENERS

A. Secure units to supports.

B. Place fasteners as indicated in manufacturer's standard.

3.03 INSTALLATION

A. Compliance: Comply with manufacturer's product data, recommendations and installation instructions for substrate verification, preparation requirements and installation.

B. Panels shall be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.

C. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather-tight installation.

D. Provide uniform, neat seams.

E. Fasteners: Conceal fasteners where possible in exposed work. Cover and seal fasteners and anchors for watertight and leakproof installation.

F. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

3.04 DAMAGED MATERIAL

A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

3.05 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damage installed products in accordance with manufacturer's instruction prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 07 42 13.03

SECTION 07 42 43
COMPOSITE WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior, panelized fiber cement cladding system and accessories to complete a drained and black-ventilated rainscreen.

B. Interior fiber cement panelized cladding system and accessories.

1.02 REFERENCE STANDARDS

A. AAMA 509 - Voluntary Test and Classification Method for Drained and Back Ventilated Rainscreen Wall Cladding Systems; 2022.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

D. ASTM C1185 - Standard Test Methods for Sampling and Testing Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards; 2023.

E. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets; 2022, with Editorial Revision (2023).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

G. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

H. 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).

I. ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

J. NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2022.

K. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.03 RELATED SECTIONS

A. Section 05 41 00 – Structural Metal Stud Framing

B. Section 06 10 00 – Rough Carpentry

C. Section 06 16 00 – Sheathing

D. Section 07 20 00 – Thermal Protection

E. Section 07 25 00 – Weather Barriers

F. Section 07 60 00 – Flashing and Sheet Metal

G. Section 07 90 00 – Joint Protection

1.04 REFERENCES

A. American Architecture Manufacturers Association (AAMA):
   1. AAMA 509-14 – Voluntary Test and Classification Method of Drained and Back Ventilated Rain Screen Wall Cladding Systems.

B. ASTM International (ASTM):
   1. ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   2. ASTM C1185 – Standard Test Method for Sampling and Testing Non-Asbestos Fiber Cement.

a. ASTM C1186 – Standard Specification for Flat Fiber-Cement Sheets.
3. ASTM E84 – Standard Test for Surface Burning Characteristics of Building Materials.
4. ASTM E119 – Standard Test for Fire Tests of Building Construction and Materials.
5. ASTM E 228 – Standard Test Method for Linear Thermal Expansion of Solid Materials with a Vitreous Silica Dilatometer.
6. ASTM E 330 – Standard Test Method Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
7. ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

C. Florida Building Code – Test Protocol HVHZ
1. Testing Application Standard (TAS) 202, 203 – HVHZ Test Procedures.

D. National Fire Protection Association (NFPA):
1. NFPA 285 – Fire Test Method for Exterior Wall Assemblies Containing Combustible Material.
2. NFPA 268 – Ignition Resistance of Exterior Wall Assemblies.

E. Standards Council of Canada & Underwriters Laboratories Canada (ULC):
1. CAN/ULC S-102 – Standard Method of Test for Surface Buring Characteristics.
2. CAN/ULC S-134 – Standard Method of Fire Test of Exterior Wall Assembly.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Submit manufacturer's provision description, storage and handling requirements, and installation instructions.

C. Product Test Reports and Code Compliance: Documents demonstrating product compliance with local building code, such as test reports or Evaluation Reports from qualified, independent testing agencies.

D. LEED Credits: Provide documentation of LEED Credits for project certification under USGBC LEED 2009 (Version 3.0) or 2012 v.4.

E. Manufacturer's Details: Submit drawings (.dwg, .rvt, and/or .pdf formats), including plans, sections, showing installation details that demonstrate product dimensions, edge/termination conditions/treatments, compression and control joints, corners, openings, and penetrations.

F. Samples: Submit samples of each product type proposed for use.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. All fiber cement panels specified in this section must by supplied by a manufacturer with a minimum of 10 years of experience in fabrication and supplying fiber cement cladding systems.
a. Products covered under this section are to be manufactured in an ISO 9001 certified facility.
2. Provide technical and design support as needed regarding installation requirements and warranty compliance provisions.

B. Installer Qualifications: All products listed in this section are to be installed by a single installer trained by manufacturer or representative.

C. Mock-Up Wall: Provide a mock-up wall as evaluation tool for product and installation workmanship.

D. Pre-Installation Meetings: Prior to beginning installation, conduct conference to verify and discuss substrate conditions, manufacturer's installation instructions and warranty requirements, and project requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Panels must be stored flat and kept dry before installation. A waterproof cover over panels and accessories should be used at all times prior to installation. Do not stack pallets more than two high. Refer to the information included on each pallet.

B. If panels are exposed to water or water vapor prior to installation, allow to completely dry before installing. Failure to do so may result in panel shrinkage at ship lap joints, and such action may void warranty.

C. Panels MUST be carried on edge. Do not carry or lift panels flat. Improper handling may cause cracking or panel damage.

D. Direct contact between the panels and the ground should be avoided at all times. It is necessary to keep panels clean during installation process.

1.08 WARRANTY

A. Provide manufacturer's 15-year warranty against manufactured defects in fiber cement panels. Additional 5-year extension available when refinished in year 14-15.

B. Provide manufacturer's 15-year warranty against manufactured defects in panel finish.

C. Warranty provides for the original purchaser. See warranty for detailed information on terms, conditions and limitations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Nichiha Corporation, 18-19 Nishiki 2-chrome Naka-ku, Nagoya, Aichi 460-9610, Japan.

B. Acceptable Manufacturer's Representative: Nichiha USA, Inc., 6465 E Johns Crossing, Suite 250, Johns Creek, GA 30097. Toll free: 1.866.424.4421, Office: 770.805.9466, Fax: 770.805.9467, www.nichiha.com.

1. Basis of Design Product: Nichiha VintageWood.
    a. Profile color: Cedar.
    b. Profile: AWP3030
    c. Accessory/Component Options:
        1) Manufactured Corners with 3-1/2" returns.
        2) Aluminum trim options: Corner Key, Open Outside Corner, H-Mold, J-Mold, Compression Joint, Inside Corner
            (a) Finish: Clear Anodized or Primed.
        3) Essential Flashing System; Starter, Overhang.
            (a) Finish: Matte black.
    d. Dimensions – AWP-3030: 455mm (17-1/8") (h) x 119.29 inch (3030 mm) (1).
    e. Panel Thickness: 0.63 inch (16 mm).
    f. Finish: Matte, lightly textured.
    g. Weight: 57.32 lbs. per panel.
    h. Coverage: 14.81 sq. ft. per panel.
    i. Factory sealed on six 6 sides.

C. Substitutions: Not permitted.

D. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 MATERIALS

A. Fiber cement panels manufactured from a pressed, stamped, and autoclave mix of Portland cement, fly ash, silica, recycled rejects, and wood fiber bundles.

B. Panel surface pre-finished and machine applied.

C. Panels profiled along 3030mm edges so that the long joints between the installed panels are ship-lapped.

D. Factory-applied sealant gasket added to top panel edge; all 3030mm edge joints contain a factory sealant.

2.03 PERFORMANCE REQUIREMENTS

A. Fiber Cement Cladding – Must comply with ASTM C1186, Type A, Grade II requirements:
   1. Wet Flexural Strength: Result: 1418 psi (9776.77 kPa), Lower Limit: 1015 psi (6998.18 kPa).
   2. Water Tightness: No water droplets observed on any specimen.
   3. Freeze-thaw: No damage or defects observed.
   4. Warm Water: No evidence of cracking, delamination, swelling, or other defects observed.
   5. Heat-Rain: No crazing, cracking, or other deleterious effects, surface or joint changes observed in any specimen.

B. Mean Coefficient of Linear Thermal Expansion (ASTM E-228): Max 1.0*10^-5in./in.F.

C. Surface Burning (CAN-ULC S102/((ASTM E84))): Flame Spread: 0, Smoke Developed: 0.

D. Wind Load (ASTM E-330): Contact manufacturer for ultimate test pressure data corresponding to framing type, dimensions, fastener type, and attachment clips. Project engineer(s) must determine Zone 4 and 5 design pressures based on project specifies.
   1. Minimum lateral deflection: L/120.

E. Water Penetration (((ASTM E331))): No water leakage observed into wall cavity.

F. Steady-State Heat Flux and Thermal Transmission Properties Test (((ASTM C518))): 16mm thick panel thermal resistance R Value of 0.47.

G. Fire Resistance (((ASTM E119))): The wall assembly must successfully endure 60-minute fire exposed without developing excessive unexposed surface temperature or allowing flaming on the unexposed side of the assembly.

H. Ignition Resistance (((NFPA 268))): No sustained flaming of panels, assembly when subjected to a minimum radiant heat flux of 12.5 k/m2 ± 5% in the presence of a pilot ignition source for a 20-minute period.

I. Fire Porpagation (NFPA 285): Wall assembly of Nichiha AWP, Ultimate Clips and Stater Track, Tyvek Commercial Wrap, 1/2” Densglass Gold Sheathing, 16” o.c. 18 gauge steel studs, mineral wool in-cavity insulation, and interior 5/8” Type X gypsum met the acceptance criteria of NFPA 285.

J. Fire Propagation (((NFPA 285))): Wall assembly of Nichiha AWP, Ultimate Clips and Starter Track, Tyvek Commercial Wrap, 1/2” Densglass Gold Sheathing, 16” o.c. 18 gauge steel studs, mineral wool in-cavity insulation, and interior 5/8” Type X gypsum met the acceptance criteria of CAN/ULC S-134.

K. Drained and Black Ventilated Rainscreen (((AAMA 509))-14): System classification: W1, V1.

L. Florida Building Code – Test Protocol HVHZ (TAS 202,203): Horizontal application Design Pressure: 95 psf, Vertical Application Design Pressure: 85 psf.

2.04 INSTALLATION COMPONENTS

A. Ultimate Clip System:
   1. Starter Track:
      a. Horizontal Panel Installations – FA 700 – 3,030mm (1) Galvalume coated steel.
      b. Vertical Panel Installations (AWP-3030 only) – FA 710T – 3,030mm (1) galvalume.
   2. Panel Clips: JEL 778 “Ultimate Clip II” (10mm rainscreen for 16mm AWP) – Zinc-Aluminum-Magnesium alloy coated steel.
   3. Corner Clips: JE 777C (10mm rainscreen for 5/8” AWP Manufacturer Coated) – Zinc-Aluminum-Magnesium alloy coated steel.
   4. Single Flange Sealant Backer – FHK 1015 R (10mm) – 6.5’ (1) fluorine coated galvalume.
   5. Double Flange Sealant Backer – FH 1015 R (10mm) – 10’ (1) fluorine coated galvalume.
   6. Corrugated Spacer – FS 1005 (5mm), FS 1010 (10mm) – 4’ (1).

B. Aluminum Trim (optional): Paint primed trim as specified in finish schedule.

C. Essential Flashing System (optional):
   1. Starter – main segments (3,030mm), inside corners, outside corners.
   2. Overhang – main segments (3,030mm), inside corners, outside corners, joint clips.

D. Fasteners: Corrosion resistant fasteners, such as hot-dipped galvanized screws appropriate to local building codes and practices must be used. Use Stainless Steel fasteners in high humidity and high-moisture regions. Panel manufacturer is not liable for corrosion resistance of fasteners. Do not use aluminum fasteners, staples or fasteners that are not rated or designed for intended use aluminum fasteners, staples or fasteners that are not rated or designed for intended use. See manufacturer's instructions for appropriate fasteners for construction method used.

E. Flashing: Flash all areas specified in manufacturer's instructions. Do not use raw aluminum flashing. Flashing must be galvanized, anodized, or PVC coated.

F. Sealant: Sealant shall comply with ASTM C920, Class 35.

PART 3 EXAMINATION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Fiber cement panels can be installed over braced wood, steel studs and sheathing including plywood, OSB, plastic foam (1" or less) or fiberboard sheathing. Fiber cement panels can also be installed over Structural Insulated Panels (SIP's), Concrete Masonry Units (CMU's) and Concrete Block Structures (CBS's) with furring strips, and Pre-Engineered Metal Construction. Insulated Concrete Forms (ICFs) require added measures. Consult with Nichiha Technical Services.
   2. Allowable stud spacing: 16" o.c. maximum.
   3. A weather resistive barrier is required when installing fiber cement panels. Use an approved weather resistive barrier (WRB) as defined by the 2015 IBC or IRC. Refer to local building codes.
   4. Appropriate metal flashing should be used to prevent moisture penetration around all doors, windows, wall bottoms, material transitions and penetrations. Refer to local building codes for best practices.

B. Examine site to ensure substrate conditions are within alignment for proper installation.

C. Do not begin installation until unacceptable conditions have been corrected.

D. Do not install panels or components that appear to be damaged or defective. Do not install wet panels.

3.02 TOLERANCE

A. Wall surface plane must be plumb and level within ± ¼ inch in 20 feet (609.6 cm) in any direction.
   1. One layer of Nichiha 5mm (~3/16") Spacer may by used as shim.

3.03 INSTALLATION

A. General: Install products in accordance with the latest installation guidelines of the manufacturer and all applicable building codes and other laws, rules, regulations and ordinances. Review all manufacturer installation, maintenance instructions, and other applicable documents before installation.
   1. Consult with local dealer or Nichiha Technical Department before installing any Nichiha fiber cement product on a building higher than 45 feet (1371.6 cm) or three stories or for conditions not matching prescribed standard installation guide requirements and methods. A Technical Design Review (TDR) process is available to evaluate project feasibility.
   2. Vertical Control/Expansion Joints are required for multi-story installations of AWP. Locate joints at floor lines. Joints are flashed minimum ½" breaks. Do not caulk. Refer to installation guide(s).

a. Wood framed buildings of three or more floors requires a compression joint at each floor.
b. Steel framed buildings (including reinforced concrete core with LGMF exterior walls) of more than three floors (or 45 feet (1371.6 cm) require a compression joint every 25 feet (762 cm) at a floor line.

B. Panel Cutting
1. Always cut fiber cement panels outside or in a well ventilated area. Do not cut the products in an enclosed area.
2. Always wear safety glasses and NIOSH/OSHA approved respirator whenever cutting, drilling, sawing, sanding or abrading the products. Refer to manufacturer SDS for more information.
3. Use a dust-reducing circular saw with a diamond-tipped or carbide-tipped blade.
a. Recommended circular saw: Makita 7-1/4” Circular Saw with Dust Collector (#5057KB).
b. Recommended blade: Tenryu Board-Pro Plus PCD Blade (#BP-18505).
c. Shears (electric or pneumatic) or jig saw can be used for complicated cuttings, such as service openings, curves radii and scrollwork.
4. Silica Dust Warning: Fiber cement products may contain some amounts of crystalline silica, a naturally occurring, potentially hazardous mineral when airborne in dust form. Consult product SDS or visit https://www.osha.gov/dsg/topics/silicacrystallin/.
5. Immediately clean dust from cut panels as it may bind to the finish.

3.04 CLEANING AND MAINTENANCE

A. Review manufacturer guidelines for detailed care instructions.

END OF SECTION 07 42 43

SECTION 07 42 93
SOFFIT PANELS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2025a.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2024.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

G. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

H. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.

I. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2023.

J. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2025.

1.02 RELATED DOCUMENT

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 01 Specification Sections, apply to this Section.

1.03 SUMMARY

A. Section Includes:
   1. Concealed-fastener, lap-seam metal wall panels.

B. Related Sections:
   1. Section 07 42 13 Metal Wall Panels

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference:
   1. Meet with Owner, Architect, Owner’s insurer if applicable, metal panel Installer, metal panel manufacturer’s representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
   2. Review and finalize construction schedule and verify availability of materials, Installer’s personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer’s written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review flashings, special siding details, wall penetrations openings, and condition of other construction that affect metal panels.
   6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.

7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review of procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 3” = 1’-0” (1:5).

C. Calculations:
   1. Include calculations with registered engineer seal, verifying wall panel and attachment method resist wind pressures imposed on it pursuant to applicable building codes.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.
   1. Include Samples of trim and accessories involving color selection.

E. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
   1. Metal Panels: 12 inches (304.8 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Manufacturer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Manufacturer Qualifications: Company specializing in Architectural Sheet Metal Products.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Remove strippable protective covering on metal panels as panels are being installed. Do not leave the film on installed panels.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Galvalume Substrate Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing or perforating.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: 20 years and 6 months from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, chipping, peeling, or failure or paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
   1. Wind Loads: As indicated on Drawings.

2.02 CONCEALED-FASTENER, LAP-SEAM METAL SOFFIT PANELS

A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Soffit Panels Formed with vertical panel edges and intermediate stiffening ribs symmetrically spaced between panel edges; with flush joint between panels.
   1. Basis-of-Design Product:
      a. Berridge FW-12 panel.
   2. Aluminum Sheet: Coil-coated sheet, ASTM B 209 (ASTM B 209M), 3105 alloy as standard with manufacturer, with H14 temper as required to suit forming operations and structural performance required.
      a. Thickness: 0.032 inch (0.81 mm).
      b. Surface: Smooth, flat finish.
      c. Exterior Finish: Two-coat fluoropolymer.
      d. Color: As selected by Architect from manufacturer's full range.
   3. Panel Coverage: 11.625 inches (295.27 mm).
   4. Panel Height: 1.0 inch (25.4 mm).

2.03 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils 0.04 inch (1.02 mm) thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Grace Ultra.
      b. Mid-States Asphalt Quick Stick HT Pro.
      c. Polygrass Polystick MTS.
      d. Soprema Lastobond Shield HT.
      e. Tamko TW Underlayment or TW Metal & Tile Underlayment.
      f. Other approved equal during bidding.
   2. Thermal Stability: Stable after testing at 240 degrees Fahrenheit (115.56 degrees Celsius); ASTM D 1970.
   3. Low-Temperature Flexibility: Passes after testing at minus 20 degrees Fahrenheit (-6.67 degrees Celsius); ASTM D 1970.

B. Felt Underlayment: ASTM D 226/D 22M, Type II (No. 30), asphalt-saturated organic felts.

2.04 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers, Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (12.7 mm) wide and 1/8 inch (3.18 mm) thick.
   2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classification required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.05 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, bucking, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricated nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form nonexpansion, but moveable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing be metal panel manufacturer.
      a. Size: As recommended be SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.06 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are accaptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:
   1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat applied by panel manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.75 ± 0.05 mil (0.00127 mm) over 0.2 ± 0.05 mil (0.00127 mm) primer coat, to provide a total dry film thickness of 0.95 ± 0.10 mil (0.00254 mm). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.

2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.03 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
    1. Shim or otherwise plumb substrates receiving metal panels.
    2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
    3. Install screws fasteners in predrilled holes.
    4. Locate and space fastenings in uniform vertical and horizontal alignment.
    5. Install panel flashing and trim as metal panel work proceeds.
    6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
    7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashing and trim around openings and similar elements with self-tapping screws.
    8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
    1. Aluminum Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use stainless-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
    1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
    2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
    3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
    4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
    5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:
    1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommended by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.

2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashing and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicate, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual". Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (304.8 cm) with no joint allowed within 24 inches (609.6 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints or intermeshing hooked flanges, not less than 1 inch (25.4 mm) deep, filled with mastic sealant (concealed within joints).

3.04 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 93

SECTION 07 46 46
FIBER CEMENT SIDING – HARDIE PANEL, ARCHITECTURAL PANEL, SOFFIT, AND TRIM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Fiber Cement Panel Siding.
B. Fiber Cement Architectural Panel Siding.
C. Trim, Fascia, Molding, and Accessories.

1.2 RELATED REQUIREMENTS

A. Section 05 12 00, Structural Steel Framing.
B. Section 05 40 00 – Cold-Formed Metal Framing.
C. Section 06 10 00 – Rough Carpentry.
D. Section 07 21 00 – Thermal Insulation.
E. Section 07 25 00 – Weather Barriers.
F. Section 07 92 00 – Joint Sealants.
G. Section 09 21 16 – Gypsum Board Assemblies.
H. Section 09 91 13 – Exterior Painting.

1.3 REFERENCE STANDARDS

A. ASCE 7, Minimum Design Loads for Buildings and Other Structures, Current Edition.
B. ASTM C1185, Standard Test Methods for Sampling and Testing Fiber-Cement Flat Sheet, Roofing and siding Shingles, and Clapboards; 2023.
C. ASTM C1186., Standard Specification for Flat Fiber-Cement Sheets; 2022, with 2023 Editorial Revision.
D. ASTM D3359, Standard Test Methods for Rating Adhesion by Tape Test; 2023.
E. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
F. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials; 2024.
G. ASTM E136, Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2022.
H. ASTM E330/E330M, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2021.
I. ICC-ES Evaluation Reports ESR-1844, ESR-2290 and ESR-2273 (IBC, IRC, CBC, CRC); Current Editions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
    a. A minimum of 2-weeks prior to the commencement of the Work of this section, conduct a preliminary pre-installation conference at project site.
    b. Meet with Owner, Architect, and Installer, and Subcontractors completing related work.
    c. Review the Following:

i. Methods and procedures to complete the Work.
ii. Substrate and installation requirements.
iii. Temporary protection requirements.
iv. Repair procedures.
v. Schedule.
vi. Other pertinent topics.

d. Provide record of discussion with meeting minutes distributed to all attendees.

1.5 SUBMITTALS

A. See Section 01 30 00, Administrative Requirements.
B. Product Data:
   a. Manufacturer's product data sheets.
   b. Manufacturer's storage and handling requirements.
   c. Manufacturer's preparation instructions.
   d. Manufacturer's installation instructions.
   e. Manufacturer's operation and maintenance instructions.
C. Shop Drawings:
   a. Provide detailed drawings showing dimensions, layout, joints, construction details, and attachments.
   b. Indicate atypical non-standard applications outside of manufacturer's standard details and specifications.
D. Selection Samples:
   a. Provide two complete sets of color ships representing manufacturer's full range of available colors and patterns for each finish product specified.
E. Verification Samples:
   a. Provide two samples, minimum 4-inch x 6-inch (100 mm x 150 mm) representing selected product, color, texture, and patterns for each finish product specified.
F. Installers qualification statement.
G. Warranty:
   a. Manufacturer's sample warranty.
   b. Manufacturer's executed written warranty, completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in work specified in this section with a minimum of [8]-years of experience with installation of products of this type.
B. Mock-up:
   a. Mock-Up: Build mock-up for evaluation of surface preparation techniques, installation workmanship, and to verify selections made from sample submittals to demonstrate aesthetic effects and set quality standards for fabrication and installation.
      i. Minimum 48-inches wide x 60-inches high or similar area as fits the layout of the building exterior.
      ii. Include outside corner on one end of mockup and inside corner on the other end.
      iii. Finish areas designated by Architect.

iv. Approval of mock-up does not constitute approval of deviations from the Contract Documents unless approved in writing.
v. Approved mock-up **[may, may not]** remain as a part of the completed work.

b. Provide a minimum of **[14]-days** notification to Architect, Installer, and Manufacturer's Representative prior to application of mock-up for review.
c. Obtain approval of mock-up from Architect prior to commencement of Work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging with labels intact until ready for installation.
B. Store siding flat on a smooth level surface and carry on its side.
C. Protect edges and corners from chipping.
D. Store materials under dry, waterproof, well-ventilated cover, elevated above grade, and kept dry prior to installation.
E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of the Authorities Having Jurisdiction.
F. Protect materials from damage, dust, or other detrimental conditions.

1.8 FIELD CONDITIONS

A. Maintain environmental conditions including temperature, humidity, and ventilation in accordance with the limits indicated in the manufacturer's written instructions.
B. Do not install products in conditions outside of the manufacturer's stated limits.

1.9 WARRANTY

A. Manufacturer's Limited, Non Pro-rated Product Warranty:
    a. Plank, Soffit, and Trim: 30-year Warranty.
    b. Color-Plus Finish: 15-year Warranty.
    c. When installed and maintained in accordance with manufacturer's written requirements, warranty for 15-years from date of purchase covering peeling, cracking, and chipping.
B. Installers Warranty:
    a. Provide **[1]-year** installers warranty covering workmanship for work of this Section.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design: James Hardie Building Products, Inc.; Hardie Panel and Hardie Architectural Panel; www.jameshardie.com.
B. Substitutions: In accordance with the requirements of Division 01, General Requirements.

2.2 FIBER CEMENT – VERTICAL PANEL SIDING

A. Fiber Cement Panel Siding:
    a. Type A, Grade II, ASTM C1186..
    b. Non-combustible Material, ASTM E136.
    c. Flame Spread Index: 0, ASTM E84.
    d. Smoke Developed Index: <5, ASTM E84.
B. Vertical Siding Panel - Type:
    a. Smooth:
        i. 4-feet (1219 mm) x 8-feet (2438 mm).
        ii. 4-feet (1219 mm) x 9-feet (2743 mm).
        iii. 4-feet (1219 mm) x 10-feet (3048 mm).
    b. Cedarmill:
        i. 4-feet (1219 mm) x 8-feet (2438 mm).
        ii. 4-feet (1219 mm) x 9-feet (2743 mm).
        iii. 4-feet (1219 mm) x 10-feet (3048 mm).
    c. Stucco:
        i. 4-feet (1219 mm) x 8-feet (2438 mm).
        ii. 4-feet (1219 mm) x 9-feet (2743 mm).
        iii. 4-feet (1219 mm) x 10-feet (3048 mm).
    d. Sierra, 8-inch (203 mm):
        i. 4-feet (1219 mm) x 8-feet (2438 mm).
        ii. 4-feet (1219 mm) x 9-feet (2743 mm).
        iii. 4-feet (1219 mm) x 10-feet (3048 mm).
C. Color:
    a. As selected by Architect from manufacturer's standard range.
D. Product:
    a. Basis-of-Design: Hardie Panel Siding; www.jameshardie.com.
    b. Substitutions: In accordance with the requirements of Division 01, General Requirements.

2.3 FIBER CEMENT – ARCHITECTURAL PANEL SIDING

A. Fiber Cement Panel Siding:
    a. Type A, Grade II, ASTM C1186.
    b. Non-combustible Material, ASTM E136.
    c. Flame Spread Index: 0, ASTM E84.
    d. Smoke Developed Index: 0, ASTM E84.
B. Vertical Siding Panel – Architectural Collection - Type:
    a. Thickness: 0.3125 inches.

b. Fine Sand:
    i. 4-feet (1219 mm) x 8-feet (2438 mm).
    ii. 4-feet (1219 mm) x 10-feet (3048 mm).
    iii. 4-feet (1219 mm) x 12-feet (3658 mm).
c. Fine Sand – Grooved:
    i. 4-feet (1219 mm) x 8-feet (2438 mm).
    ii. 4-feet (1219 mm) x 10-feet (3048 mm).
    iii. 4-feet (1219 mm) x 12-feet (3658 mm).
d. Mounded Sand:
    i. 4-feet (1219 mm) x 8-feet (2438 mm).
    ii. 4-feet (1219 mm) x 10-feet (3048 mm).
    iii. 4-feet (1219 mm) x 12-feet (3658 mm).
e. Sea Grass:
f. 4-feet (1219 mm) x 8-feet (2438 mm).
g. 4-feet (1219 mm) x 10-feet (3048 mm).
h. 4-feet (1219 mm) x 12-feet (3658 mm).

C. Color:
    a. As selected by Architect from manufacturer's standard range.
D. Product:
    a. Basis-of-Design: Hardie Architectural Panel Siding; www.jameshardie.com.
    b. Substitutions: In accordance with the requirements of Division 01, General Requirements.

2.4 FIBER CEMENT NON-VENTED SOFFIT PANELS

A. Type A, Grade II, ASTM C1186.
B. Non-combustible Material, ASTM E136.
C. Flame Spread Index: 0, ASTM E84.
D. Smoke Developed Index: <5, ASTM E84.
E. Thickness: 1/4-inch (6 mm).
F. Type:
    a. Smooth:
        i. 12-inches (305 mm) x 12-feet (3658 mm).
        ii. 16-inches (406 mm) x 12-feet (3658 mm.
        iii. 24-inches (610 mm) x 8-feet (2438 mm).
G. Color:
    a. As selected by Architect from manufacturer's standard range.
H. Product:
    a. Basis-of-Design: HardiePlank; www.jameshardie.com.
    b. Substitutions: In accordance with the requirements of Division 01, General Requirements.

2.5 FIBER CEMENT VENTED SOFFIT PANELS

A. Type A, Grade II, ASTM C1186.
B. Non-combustible Material, ASTM E136.
C. Flame Spread Index: 0, ASTM E84.
D. Smoke Developed Index: <5, ASTM E84.

E. Net Free Ventilation: 5-square inches per linear foot (10583 sq. mm per linear meter).
F. Thickness: 1/4-inch (6 mm).
G. Type:
    a. Smooth:
        i. 12-inches (305 mm) x 12-feet (3658 mm).
        ii. 16-inches (406 mm) x 12-feet (3658 mm),
        iii. 24-inches (610 mm) x 8-feet (2438 mm).
    b. Textured Cedarmill:
        i. 12-inches (305 mm) x 12-feet (3658 mm).
        ii. 16-inches (406 mm) x 12-feet (3658 mm).
        iii. 24-inches (610 mm) x 8-feet (2438 mm).
H. Color:
    a. As selected by Architect from manufacturer's standard range.
I. Product:
    a. Basis-of-Design: HardiePlank; www.jameshardie.com.
    b. Substitutions: In accordance with the requirements of Division 01, General Requirements.

2.6 FIBER CEMENT VENTED PLUS SOFFIT PANELS

J. Type A, Grade II, ASTM C1186.
K. Non-combustible Material, ASTM E136.
L. Flame Spread Index: 0, ASTM E84.
M. Smoke Developed Index: 5, ASTM E84.
N. Net Free Ventilation: 12.6-square inches per linear foot (26670 sq. mm per linear meter).
O. Thickness: 1/4-inch (6 mm).
P. Type:
    a. Smooth, Vented:
        i. 12-inches (305 mm) x 12-feet (3658 mm).
        ii. 16-inches (406 mm) x 12-feet (3658 mm).
        iii. 24-inches (610 mm) x 8-feet (2438 mm).
    b. Textured Cedarmill:
        i. 12-inches (305 mm) x 12-feet (3658 mm).
        ii. 16-inches (406 mm) x 12-feet (3658 mm).
        iii. 24-inches (610 mm) x 8-feet (2438 mm).
Q. Color:
    a. As selected by Architect from manufacturer's standard range.
R. Product:
    a. Basis-of-Design: HardieSoffit VentedPlus Panels; www.jameshardie.com.
    b. Substitutions: In accordance with the requirements of Division 01, General Requirements.

2.7 ACCESSORIES

A. HardieTrim Trim Boards; www.jameshardie.com.
    a. Type A, Grade I, ASTM C1186..

b. Flame Spread Index: 0, ASTM E84.
c. Smoke Developed Index: <5, ASTM E84.
d. Batten Board: 2-1/2 inch (63 mm) width.
e. 4/4 Boards:
    i. 3-1/2 inch (89 mm) width.
    ii. 5-1/2 inch (140 mm) width.
    iii. 7-1/4 inch (184 mm) width.
    iv. 9-1/4 inch (235 mm) width.
    v. 11-1/4 inch (286 mm) width.
f. 5/4 Boards:
    i. 3-1/2 inch (89 mm) width.
    ii. 5-1/2 inch (140 mm) width.
    iii. 7-1/4 inch (184 mm) width.
    iv. 9-1/4 inch (235 mm) width.
    v. 11-1/4 inch (286 mm) width.
g. Color:
    i. As selected by Architect from manufacturer's standard range.
h. Texture:
    i. Smooth.
    ii. Rustic.
    iii. Wood Grained.
i. Length: 12-feet (3658 mm).
j. Thickness:
    i. 3/4-inch (19 mm).
    ii. 1-inch.

B. Seam Tape: HardieWrap; www.jameshardie.com.
C. Flashing:
    a. HardieWrap Flashing Tape; www.jameshardie.com.
    b. HardieWrap Flex Flashing Tape; www.jameshardie.com.
D. Fasteners:
    a. Wood Framing Fasteners:
        i. 4d common corrosion resistant nails.
        ii. 6d common corrosion resistant nails.
        iii. 8d box ring common corrosion resistant nails.
        iv. 0.089-inch (2.2 mm) shank x 0.221-inch (5.6 mm) head x 2-inches (51 mm) corrosion resistant siding nails.
        v. 0.093-inch (2.4 mm) shank x 0.222-inch (5.6 mm) head x 2-inches (51 mm) corrosion resistant siding nails.
        vi. 0.093-inch (2.4 mm) shank x 0.222-inch (5.6 mm) head x 2-1/2 inches (64 mm) corrosion resistant siding nails.
        vii. 0.091-inch (2.3 mm) shank x 0.221-inch (5.6 mm) head x 1-1/2 inches (38 mm) corrosion resistant siding nails.
        viii. 0.091-inch (2.3 mm) shank x 0.225-inch (5.7 mm) head x 1-1/2-inches (38 mm) corrosion resistant siding nails.

ix. 0.121-inch (3 mm) shank x 0.371-inch (9.4 mm) head x 1-1/4 inches (32 mm) corrosion resistant roofing nails.
x. No. 11 gauge 1-1/4 inches (32 mm) corrosion resistant roofing nails.
xi. No. 11 gauge 1-1/2 inches (38 mm) corrosion resistant roofing nails.
xii. No. 11 gauge 1-3/4 inches (44 mm) corrosion resistant roofing nails.
xiii. 16 gauge 1-1/2 inches (38 mm) stainless finish nails.

b. Metal Framing Fasteners:
i. 1-1/4 inches (32 mm) No. 8-18 x 0.375-inch (9.5 mm) head self- drilling, corrosion resistant S-12 ribbed buglehead screws.
ii. 1-5/8 inches (41 mm) No. 8-18 x 0.323-inch (8.2 mm) head self- drilling, corrosion resistant S-12 ribbed buglehead screws.
iii. 1-inch (25 mm) No. 8-18 x 0.323-inch (8.2 mm) head self-drilling, corrosion resistant ribbed buglehead screws.
iv. 1-inch (25 mm) No. 8-18 x 0.311-inch (7.9 mm) head self-drilling, corrosion resistant S-12 ribbed buglehead screws.
v. 1.5-inch (38 mm) [AGS-100] .100-inches x 25-inches (2540 mm x 635 mm) ETandF Pin or equivalent pneumatic fastener.

c. Masonry Walls:
i. Aerico Stud Nail, ET&F ASM No.-144-125, 0.14-inch (3.6 mm) shank x 0.30-inch (7.6 mm) head by 2-inches (51 mm) long corrosion resistant nails.

2.8 FINISHES

A. Factory Primer: Provide factory applied universal primer.
a. Primer: Factory primed by manufacturer.
b. Topcoat: Reference Section 09 90 00, Painting and Coating and project Finish Schedule.

B. Factory Finish: Reference project Finish Schedule.
a. As supplied by manufacturer.
b. Factory applied finish is finish applied by the same company and in the same facility that manufactures the siding substrate.
c. Require factory applied finish by fiber cement manufacturer applied in controlled environment within manufacturer's facility utilizing multi-coat, heat cured finish within one manufacturing process.
d. Each finish color to have documented color match to Delta E of 0.5 or better between product lines, manufacturing lots, or production runs as measured by photospectrometer and verified by third party.
e. Provide factory applied finish protection prior to transit to site. Remove finish protection after installation.
f. Accessories: Provide complete finishing system including pre-packaged touch-up kit provided by manufacturer.
g. Provide quantities as recommended by manufacturer.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. Examine substrate, clean and repair to eliminate conditions detrimental to installation.
C. Do not commence with the Work until unacceptable conditions are remedied.
D. Verify that weather barrier is installed over substrate and ready to receive the Work.
E. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation prior to commencement of Work.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using methods recommended by manufacturer's written requirements.
C. Protect surrounding work areas and surface during installation.
D. Repair punctures or tears in weather barrier prior to installation of siding.

3.3 WEATHER BARRIER

A. See Section 07 25 00, Weather Barriers.
B. Ensure weather barrier is installed with penetration and junction flashing in accordance with manufacturer's written requirements and the Authorities Having Jurisdiction.

3.4 INSTALLATION – PANEL SIDING

A. Install in strict accordance with manufacturer's written installation instructions at locations shown on Drawings.
B. General:
    a. Protect siding from Work of other trades.
    b. Surfaces to be dry prior to installation of weather barriers and siding.
    c. Reference trim details on Drawings.
    d. Touch-up cut edges prior to installation.
C. Flashing:
    a. Install above door and window trim and casings.
    b. Install above horizontal trim in field of siding.

3.5 INSTALLATION OF SOFFIT AND VENTED PANELS

A. Install in strict accordance with manufacturer's written installation instructions at locations shown on Drawings.
B. Panels may be installed as soffit or ceiling over wood or steel framing.
C. 20-gauge (33 mil) minimum to 16-gauge (54 mil) in compliance with the Authorities Having Jurisdiction.
D. Additional framing may be necessary to ensure proper fastening of siding.

3.6 INSTALLATION OF TRIM BOARDS

A. Install in strict accordance with manufacturer's written installation instructions at locations shown on Drawings.
B. Install flashing around all wall openings.

3.7 FINISHING

A. Finish in accordance with paint manufacturer's written application instructions.
B. Finish unprimed siding with a minimum of one coat of manufacturer approved primer and one coat of 100 percent **[acrylic];[latex]** exterior grade topcoat or two coats of manufacturer approved high quality alkali resistant 100 percent **[acrylic; latex]** exterior grade topcoat within 90-days of installation.
C. Finish factory primed siding with a minimum of one coat of manufacturer approved high quality 100 percent **[acrylic][latex]** exterior grade paint within 180-days of installation.

3.8 CLEANING

A. See Section 01 70 00, Execution and Closeout Requirements.
B. Clean siding in accordance with manufacturer's written instructions using materials and methods acceptable to manufacturer.

3.9 PROTECTION

A. Protect installed products until date of Substantial Completion.
B. Touch-up, repair or replace damaged areas prior to date of Substantial Completion.

END OF SECTION 07 46 46

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes sheet metal roof-edge trim and flashing not covered in pre-engineered metal building Section.

B. Submittals: Product Data, Show Drawings, and Samples for each item specified.

PART 2 PRODUCTS

2.01 ALUMINUM-COATED (GALVALUME) STEEL SHEET: ASTM A 792 GRADE 50 (A 792M-AZ50); STRUCTURAL QUALITY, SATIN FINISH, MILLOILS, CHEMICALS AND RESIDUE REMOVED.

A. Miscellaneous Materials and Accessories: As follows:
   1. Fasteners: Noncorrosive metal. Match finish of exposed heads with material being fastened.
   2. Asphalt Mastic: SSPC-Paint 12, asbestos free, solvent type.
   3. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.
   4. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
   5. Elastomeric Sealant: As specified in Division 7 Section “Joint Sealants”.
   6. Clips, Straps, Anchoring Devices, and Similar Accessories: Compatible with material being installed.

B. Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA’s “Architectural Sheet Metal Manual” that apply to the design, dimensions, metal, and other characteristics of the item indicated.

C. Coil-Coated Galvalume Finish: 2-coat fluoropolymer Hylar 5000 or Kynar 500.
   1. Color and Gloss: As selected by Architect.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation: comply with manufacturer’s instructions and SMACNA’s “Architectural Sheet Metal Manual” allow for thermal expansion; set true to line and level as indicated. Install Work with laps, joints, and seams permanently watertight and weatherproof; conceal fasteners where possible.
   1. Roof-Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.

B. Expansion Provisions: Provide for thermal expansions of exposed sheet metal Work. Space movement joints at maximum of 10 feet (304.8 cm) with no joints allowed within 24 inches (609.6 mm) of corner of intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25.4 mm) deep, filled with mastic sealant (concealed within joints).

C. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joints with sealant and form metal to completely conceal sealant.

D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.

E. Separations: Separate noncompatible metals or corrosive substrates with a coating of asphalt mastic or other permanent separation as recommended by manufacturer.

F. Counterflashings: Coordinate installation with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or bind rivets and sealant. Lap counterflashing joints a minimum of 2 inches (50.8 mm) and bed with sealant.

END OF SECTION 07 62 00

SECTION 07 71 23
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

F. ASTM B32 - Standard Specification for Solder Metal; 2020.

G. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

1.02 SUMMARY

A. Section includes pie-finished sheet metal gutters and downspouts.

B. Related Section:
   1. Section 07 62 00 – Sheet Metal Flashing and Tinn.
   2. Section 07 90 00 – Joint Protection.

1.03 REFERENCES

A. American Architectural Manufacturer's Association:
   1. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.
   2. AAMA 2603 – Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2604 – Voluntary specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
   4. AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

B. ASTM International:
   1. ASTM A653/A653M – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-L on Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A666 – Standard Specification for Austenitic Stainless Steel Sheet, Surp. Plate, and Flat Ba.
   3. ASTM B32 – Standard Specification for Solder Metal.
   4. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   5. ASTM B370 – Standard Specification for Copper Sheet and Std ip for Building Construction.
   6. Federal Specification Unit:
      a. FS TT-C-94 – Coating Compound, Bituminous, Solvent Type, Acid Resistant

C. Sheet Metal and Air Conditioning Conti actors:
   1. SMACNA – Architectural Sheet Metal Manual

1.04 DESIGN REQUIREMENTS

A. Conform to applicable code for size and method of rain water discharge.

1.05 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Submittal procedures.

B. Shop Drawings (Submittals for Record): Provide drawings to indicated profiles, quantities, and details.

C. Samples (Submittals for Review): Provide samples for confirmation of color and finish.

1.06 QUALITY ASSURANCE

A. Per for in Worm in accordance with SMACNA Manual.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope to prevent contact with materials during storage capable of causing discoloration, staining, or damage.

1.08 COORDINATION

A. Section 01 30 00 – Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with downspouts discharge pipe inlet.

1.09 WARRANTY

A. Section 01 70 00 – Execution and Closeout Requirements: Product want an ties and product bonds.

B. Furnish 5-year manufacture warranty for gutted and downspout finishes.

PART 2 PRODUCTS

2.01 GUTTERS AND DOWNSPOUTS

A. Manufactures:
   1. Bet get Building Products Corp.
   2. Klauer Manufacturing Co.
   3. Oboyke, Inc.
   4. Substitutions: Section 01 60 00 – Product Requirements.

B. Product Description:
   1. Gutters: Sheet metal; Rectangular style profile.
   2. Downspout Boots and Shoes: Cast Iron.

2.02 COMPONENTS

A. Pie-Finished Galvanized Steel Sheet: ASTM A653/A653M, G90 zinc coating; 0.02-inch 24 gauge core steel, shop pie-coated with acrylic coating; color as selected ft om manufacturer's standards.

2.03 ACCESSORIES

A. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: Type recommended by fabrication.
   2. Gutted Supports: Straps
   3. Downspouts Supports: Straps

B. Fastened: Same material and finish as gutters and downspouts, with soft neoprene washers.

C. Primer: Galvanized ii on type.

D. Protective Backing Paint: FS TT-C-494, bituminous.

2.04 FABRICATION

A. For in gutters and downspouts of profiles and sizes indicated.

B. Fabricate with required connection pieces.

C. For in sections to shape indicated on Drawings, square, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutted and downspout accessories; solder water tight.

2.05 FACTORY FINISHING

A. Acrylic polyester coating: Baked enamel system conforming to AAMA 2603.

B. Pt inner Coat: Finish concealed side of metal sheets with pi inner compatible with finish system, as recommended by finish system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 – Administrative Requirements: Coordination and project conditions.

B. Verify surfaces are ready to receive gutters and downspouts.

3.02 PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective basking paint to a minimum drying film thickness of 15 mil (0.381 mm).

3.03 INSTALLATION

A. Slope gutters 1/4 inch (6.35 mm) per foot minimum.

B. Sodder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

C. Connect downspouts to downspout boots and shoes at 8 inches (203.2 mm) above grade. Seal connection water tight.

END OF SECTION 07 71 23

SECTION 07 84 13
FIRESTOPPING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

1.02 SUMMARY

A. This section includes through-penetration firestop systems for penetrations through fire-resistance-rated assemblies, including both empty openings and openings containing penetrations items.

B. Performance Requirements: Provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.
   1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
   2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E814, where systems protect penetrating items exposed to potential contract with adjacent material in occupied floor areas:
      a. Penetrations located outside wall cavities.
      b. Penetrations located outside fire-resistive shaft enclosures.
      c. Penetrations located in construction containing fire-protection-rated openings.
      d. Penetrating items larger than 4-inch- (100-mm-) diameter nominal pipe or 16 sq. in. (100 sq. cm) in overall cross-sectional area.
   3. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
      a. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
      b. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
   4. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E84.

C. Submittals:
   1. Product data for each type of product specified.
   2. Shop Drawings: For each through-penetration firestops system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction.
   3. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
   4. Product Test Reports: Form a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in “Performance Requirements” Paragraph:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency in UL, ITS, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E814 and bear classification marking of qualified testing and inspection agency.

PART 2 PRODUCTS

2.01 MATERIALS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicted for each application of Drawings.

B. Through-penetration Firestop Systems: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, complying with performance requirements, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

C. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with “Performance Requirements” Paragraph. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
   1. Permanent forming/damming/backing materials.
   2. Temporary forming materials.
   3. Substrate primers.
   4. Collars.
   5. Steel sleeves.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Install through-penetration firestop systems to comply with “Performance Requirements” Paragraph and firestop system manufacturer’s written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. If required by authorities having jurisdiction, identify through-penetrations firestop systems with pressure-sensitive, self-adhesive, prepainted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop systems installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
   1. The words: “Warning--Through-Penetration Firestop Systems--Do Not Disturb. Notify Building Management of Any Damage.”
   2. Contractor’s name, address, and phone number.
   3. Through-penetration firestop system designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Through-penetration firestop system manufacturer’s name.
   6. Installer’s name.

D. Fire rated partitions shall be identified ad required by Authority Having Jurisdiction but at a minimum stenciled 15 feet (457.2 cm) from end of wall section and spaced 30 feet (914.4 cm) in Red Paing (SW 6871 “Positive Red”). Lettering to be stenciled not less than 3 inches (76.2 mm) and minimum 3/8” stroke.
   1. Stencil to read – “1 HOUT FIRE RATED ASSEMBLY – PROTECT ALL OPENINGS AND PENETRATIONS”

END OF SECTION 07 84 13

SECTION 07 92 00
JOINT SEALERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork, and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018 (Reapproved 2023).

1.02 SUMMARY

A. Provide sealants at intersection of building components.

1.03 SUBMITTALS

A. Submit for review samples, product data, and installation instructions.

B. Submit certification that materials are compatible with other materials in the joint system, or, of not compatible, recommendation and certification of other products that can be so certified.

1.04 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Joints designed for expansion and movement conditions at site:
   1. Exterior joints on vertical surfaces: Non-sag two-part polyurethane, modified; Tremco Dymeric or equal acceptable to the Architect.
   2. Horizontal paving joints: Self-leveling polyurethane; Tremco THC 900 or equal acceptable to the Architect.
   3. Interior joints: Acrylic latex; Sherwin Williams 950A.
   4. Seam sealant for small metal-to metal joints: Tremco Seam Sealer or equal acceptable to the Architect.
   5. Pre-compressed expanding sealant tape; Emseal PC-SA or equal acceptable to the Architect.
   6. Acoustical Sealant: U.S. Gypsum Acoustical Sealant or equal acceptable by the Architect.
   7. Pavement joint filler: Cork joint filler, resilient and non-extruding, ASTM D1752, TYPE 2, or AASHTO M153, TYPE 2.
   8. Primers, bond breakers, and backer rods compatible with sealant and adjacent surfaces. Backer rods: closed-cell extruded polymer foam.
   9. Fire-retardant sealant: Non-shrinking, non-migrating polyisobutylene/ polybutene sealant, 3M Barrier Caulk, CP-25 or equal acceptable to the Architect.
   10. Acrylic Glazing Sealant: Tremco Mono or equal acceptable to the Architect.
   11. Bearing pads: Continuous Neoprene bearing pads of width and thickness to match existing at steel-framed concrete lift-out panels over transformer vault; with associated compatible cements and sealants, if any, required for watertight installation.
   12. Neoprene tubing and gaskets: Where shown, provide continuous neoprene extrusions of shape or diameter and wall thickness appropriate for the application.
   13. Compressible fire-retardant joint filter: USG "Thermafiber" mineral fiber blanket fire safe material.

PART 3 EXECUTION

3.01 INSTALLATION

A. Examine substrate; report unsatisfactory conditions in writing. Beginning work means acceptance of substrates.

B. Provide sealants in colors selected by Architect from manufacturer's standard colors.

C. Provide multiple masonry veneer control joint sealant colors matching adjacent masonry. Do not match mortar color. Change sealant color as adjacent masonry color changes. Coordinate with Architect where multi-masonry colors exist.

D. Install materials and systems in accordance with manufacturer's instructions and reviewed submittals. Install materials and systems in proper relation with adjacent construction and with uniform smooth appearance. Coordinate with work of other sections. Clean and prime joints, and install bond breakers, backer rods and sealant as recommended by manufacturers.

E. Depth shall equal width up to 1/2" wide; depth shall equal 1/2 width for joints over 1/2" wide, except fill joints completely with fire-retardant products.

F. Cure and protect sealants as directed by manufacturers. Replace or restore damaged sealants. Clean adjacent surfaces to remove spillage and smears.

G. Clean other work damaged or soiled by work of this Section.

END OF SECTION 07 92 00

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide items shown on the drawings and specified, including, but not limited to the following:
   1. Standard steel doors.
   2. Steel frames for doors, sidelites, transoms, and windows.
   3. Louvers and vision lites in steel doors, if shown or required.
   4. Sound rated steel doors.

1.02 REFERENCE STANDARDS

A. ASTM E413 - Classification for Rating Sound Insulation; 2022.

B. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).

1.03 RELATED WORK

A. Section 04 20 00, Unit Masonry

B. Section 05 40 00, Cold-Formed Metal Framing

C. Section 05 50 00, Metal Fabrications

D. Section 08 14 23.16, Plastic Laminate Faced Wood Doors

E. Section 08 71 00, Finish Hardware

F. Section 08 80 00, Glazed Systems: Glazing in doors, sidelites, transoms, and windows.

G. Section 09 91 00, Painting

1.04 REFERENCES

A. American National Standards Institute (ANSI)
   1. A115.IG, Installation Guide for Doors and Hardware
   2. A224.1, Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors & Frames.
   3. A250.8, Recommended Specifications for Standard Steel Doors and Frames. (Formerly SDI-100)
   4. A250.11, Recommended Erection Instructions for Steel Frames (Formerly SDI-105).

B. ASTM International (ASTM)
   1. A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   2. A924, Standard Specification for General Requirements for Steel, Sheet, Metallic-Coated by the Hot-Dip Process
   3. A1008, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
   4. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability
   5. C1363 – Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus
   6. E413 – Standard Classification for Rating Sound Insulation
   7. E2074, Standard Standard Test Method for Fire Tests of Door Assemblies (Formely A152)

C. Federal Specification (Fed Spec)
   1. Fed Spec C578 Bead Fusion Test

D. Hollow Metal Manufacturers Association (HMMA)
   1. HMMA 802 – Manufacturing of Hollow Metal Doors and Frames.
   2. HMMA 810 – Hollow Metal Doors.

3. HMMA 830 – Hardware Preparation and Locations for Hollow Metal Doors and Frames.
4. HMMA 840 – Installation and Storage of Hollow Metal Doors & Frames.
5. HMMA 850 – Fire Rated Hollow Metal Doors & Frames.
6. HMMA 890 – Technical Summary of Hollow Metal by HMMA.

E. National Fire Protection Association (NFPA)
1. 80, Fire Doors and Fire Windows
2. 252, Fire Tests of Door Assemblies

F. Steel Door Institute
1. Technical Data Series

G. Underwriters Laboratories Inc. (UL)
1. Building Materials Directory
2. Listing and Labeling
3. 10B and 10C, Fire Tests of Door Assemblies
4. 1784, Air Leakage Tests of Door Assemblies

H. Intertek Testing, Services (Warnock Hersey, Inc. (WHI))
1. Listing and Labeling

1.05 SUBMITTALS

A. Product Data:
1. Manufacturer's standard details and catalog data demonstrating compliance with specifications and referenced standards.
2. Manufacturer's installation instructions.

B. Shop Drawings:
1. Indicate complete schedule in detail for each steel door and frame using the same reference number for details and openings as those on the Contract Drawings. If any door is not by the steel door manufacturer only the door opening number should be shown along with the type of door (wood, plastic laminate faced, etc.).
2. Show details of construction, installation, connections, anchors, hardware reinforcement, hardware preparation, louvers, and floor and threshold clearances.

C. Samples:
1. 12-inch x 12-inch sample of a fire-rated and non-rated door, cut from corner of door, showing door construction.
2. 12-inch x 12-inch sample of each type of door louver specified or required, showing louver construction.
3. 6-inch long sample of a fire-rated, non-rated frame, and each type of glass stop specified or required, showing corner and construction.

D. Certificates:
1. Manufacturer's certification that oversized openings are in compliance with specifications.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: If other than a manufacturer listed under Paragraph 2.1 is proposed for use on the Project, it shall be a company specialized in the manufacture of steel doors and frames of the type specified for this Project with a minimum of five (5) year experience.

B. All steel doors and frames shall be by a single manufacturer.

1.07 PRE-INSTALLATION

A. Refer to Section 01 31 00, Projection Management and Coordination.

1.08 COORDINATION

A. Coordination the Work of this Section with work in which hollow metal work is installed.

B. Coordinate hardware installation with opening construction. Finish hardware is specified in Section 08 71 00, Finish Hardware.

C. Coordinate doors, frames, and windows with glazing specified in Section 08 80 00, Glazed Systems.

D. Coordinate doors and frames with painting specified in Section 09 91 00, Painting.

1.09 DELIVERY, STORAGE AND HANDLING

A. Delivery and store products in accordance with manufacturer's instructions, and as follows:
   1. In manufacturer's original, clearly labeled, undamaged containers or wrappers.
   2. Containers or wrappers shall list the name of the manufacturer and product.

B. Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the schedule time of installation.

C. Protect products from moisture, construction traffic, and damage.
   1. Store under cover in a clean, dry place, protected from weather and abuse.
   2. Store in a manner that will prevent rust or damage.
   3. Store doors in a vertical position, spaced with blocking to permit air circulation.
   4. Do not use non-vented plastic or canvas shelters.
   5. Should containers or wrappers become wet, remove immediately.

1.10 WARRANTY

A. Warranty the work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.

B. Defects shall include, but not be limited to:
   1. Use of incorrect materials in opening.
   2. Incorrect labeled components installed within opening.
   3. Noisy, rough or difficult operation.
   4. Failure to meet specified quality assurance requirements.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURER

A. Manufacturers listed below whose products meet or exceed the specifications are approved for use in the Project. Other manufacturers must comply with Paragraph 1.5, A, Manufacturer Qualifications, must manufacturer equivalent products to those specified and comply with requirements of Division 1 regarding substitutions to be considered.
   1. Amweld building Products, Inc., Garrettsville, OH; (330) 527-5122
   2. American Door Products, Houston, TX; (713) 681-9047 (Pearland Industries, Inc.)
   3. CECO Door Products, Brentwood, TN; (615) 661-5030
   4. Curries Company, Mason City, IA; (515) 423-1334
   5. Deansteel Mfg. Co., San Antonio, TX; (615) 210-226-8271
   6. Door Pro Systems, Inc., Houston, TX; (713) 462-0860
   7. P-W Metal Product, Inc., Garland, TX; (214) 487-0454
   8. Republic Builders Products Company, McKinzie, TN; (800) 733-3667
   9. Rocky Mountain Metals, Inc., Ranton, NM; (505) 445-2756
   10. Steelcraft Mfg. Co., Cincinnati, OH; (513) 745-6400

2.02 GENERAL MATERIALS

A. Steel requirements, all frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM-A1008 general requirements. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A1011.

B. Exterior doors/frames and interior frames where shown on drawings or required in damp, moist, humid, and wet areas, i.e., toilets, locker rooms, showers, etc., to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel and galvannealed to 'A-60'

minimum coating weight standard per ASTM-A653 and A924, with coating weight of not less than 0.60 ounce per square foot (0.30 ounce per square foot per side).

2.03 FRAME FABRICATION

A. Minimum Gauges:
   1. Interior Openings:
      a. 4-feet 0-inches or Less in Width: 16 gauge
      b. Over 4-feet 0-inches in Width: 14 gauge
   2. Exterior Openings: 14 gauge

B. Design and Construction
   1. Frames shall be custom made, welded units with integral trim of sizes and shapes shown on approved shop drawings. Hinge jambs that butt adjacent 90 degrees walls shall have at least 4-inch wide frame face to assure the door trim will not strike the wall prior to that door opening at least 90 degrees. Frames profile shall match wall thickness where practical, i.e., 4-3/4 inch (121 mm) at 4-inch CMU, 6 3/4-inch at 6-inch CMU, 8 3/4-inch at 8-inch CMU. At masonry wall openings, fabricate frames to suit masonry opening with 2-inch head member.
   2. Frames shall be strong and rigid, neat in appearance, square, true and free of defects, warp and buckle. Molded members shall be clean cut, straight and of uniform profile throughout their length.
   3. Jamb depths, trim, profile and backbends shall be as shown on approved shop drawings.
   4. Corner joints, including face and inside corners, shall have contact edges closed tight, with trim faces mitered and continuously welded, and stops butted. The use of gussets shall bot be permitted. Face of frame shall be ground smooth. Knockdown (KD) frames are not permitted.
   5. Minimum depth of stops shall be 5/8 inch (15.88 mm), except at fire windows where minimum depth of stops shall be 3/4 inch (19.05 mm).
   6. Frames for multiple openings shall have mullion and rail members which are closed tubular shapes having no visible seams or joints. Joints between faces of abutting members shall be securely welded and finished smooth. Mullions shall be key locked removable type. Keys shall be master keyed to Owner’s keying system.
   7. Hardware Reinforcements:
      a. Frames shall be mortised, reinforced, drilled and tapped at factory for fully template mortised hardware in accordance with approved hardware schedule and templates provided by Section 08 71 00, Finish Hardware. Where surface-mounted hardware is to be applied, frames shall have reinforcing plates only.
      b. Minimum thickness of hardware reinforcing plates shall be as follows.
         1) Hinge and Pivot Reinforcements 1-1/4 inch (32 mm) x 10 inch (254 mm) minimum size): 7 gauge
         2) Strike Reinforcements: 12 gauge
         3) Flush Bolt Reinforcements: 12 gauge
         4) Closer Reinforcements: 12 gauge
         5) Reinforcements for Surface-Mounted Hardware, Hold-Open Arms, Surface Panic Devices: 12 gauge
   8. Floor Anchors: Minimum 14 gauge, securely welded inside each jamb, with holes for floor anchorage.
   9. Jamb Anchors:
      a. Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the T-Strap type. Anchors shall be not less than 16 gauge steel. The number of anchors provided at each jamb shall be as follows:
         1) Frames up to 7 feet (213.36 cm)-6 inch (152.4 mm) height – Three (3) anchors
         2) Frames 7 feet (213.36 cm)-6 inch (152.4 mm) to 8 feet (243.84 cm)-0 inch (0 mm) height – Four (4) anchors

3) Frames over 8 feet (243.84 cm)-0 inch (0 mm) height – One (1) anchor for each 2-feet or fraction thereof in height.

b. Frames for installation in wood or metal stud partitions shall be provided with steel anchors of suitable approved design, not less than 16 gauge thickness, securely welded inside each jamb as follows:
   1) Frames up to 7-feet 6-inch height – Four (4) anchors
   2) Frames 7-feet 6-inch to 8-feet 0-inch height – Five (5) anchors
   3) Frames over 8-feet 0-inch height – Four (4) anchors plus one (1) additional for each 2-feet or fraction thereof over 8-feet 0-inches.

c. Frames to be anchored to previously placed concrete, masonry or structural steel shall be provided with anchors of suitable design as shown on approved shop drawings.

10. Dust Cover Boxes: Shall be of not less than 26 gauge steel and shall be provided at all mortised hardware items. 8-inch CMU walls with face brick shall have duel offset jamb anchors.
11. Steel Spreader: Shall be provided on all frames, temporarily attached to bottoms of both jambs for bracing during shipping and handling.
12. Loose Glazing Stops: Shall be of cold rolled steel, not less than 20 gauge, butted at corner joints and secured to the frame with countersunk cadmium or zinc-plated screw. Loose stops at exterior frames shall be placed on the exterior side of the frames, unless otherwise shown.
13. At sound rated door openings and at masonry openings, coat inside of frame profile with bituminous coating to minimum thickness of 1/16 inch (1.59 mm).

C. Frame Color: Field painted under Section 09 91 00, Painting, to match face of door.

2.04 DOOR FABRICATION

A. Minimum Gauges:
   1. Interior Doors: 0.047 inch (1.19 mm) or 18 gauge
   2. Exterior Doors: 0.059 inch (1.5 mm) or 16 gauge

B. Design and Construction:
   1. Type: Doors shall be custom fabricated, of types and sizes shown on approved shop drawings, and shall be fully welded seamless construction with no visible seams or joints on faces or vertical edges.
   2. Thickness: Shall be 1 3/4-inch, unless specifically noted or shown otherwise.
   3. Fabrication:
      a. Doors shall be strong, rigid and neat in appearance, free from warpage and buckle.
      b. Corner bends shall be true and straight and of minimum radius for gage of metal used.
      c. Provide 22 gauge steel stiffeners spaced a maximum 6-inches on center and extending full height of door.
      d. Fill interior with noncombustible fiberglass insulation. Use mineral board filler as required for labeled doors.
      e. Faces shall be joined at vertical edges of door by a continuous weld extending full height of door. Welds shall be ground, filled and dressed smooth to provide a smooth surface.
      f. Top and bottom edges shall be closed with a continuous recessed steel channel not less than 16 gauge, extending full width of door and spot weld to both faces. Exterior doors shall have an additional flush closing.
      g. Doors within wet of humid areas shall have a top cap and solid foam interior core to prevent internal moisture accumulation.
      h. Edge profile shall be provided on both vertical edges of doors as follows:
         1) Single-Acting Swing Doors: Beveled 1/8-inch in 2-inches.
      i. Hardware Reinforcements:

1) Doors shall be mortised, reinforced, drilled and tapped at factory for fully template hardware, in accordance with the approved hardware schedule and templates provided by Section 08 71 00, Painting. Where surfaced-mounted hardware is to be applied, doors shall have reinforcing plates shall be as follows:
2) Minimum gauges for hardware reinforcing plates shall be as follows:
   (a) Hinge & Pivot Reinforcements: 7 gauge
   (b) Reinforcements for Lock Face, Flush Bolts, Concealed Holders, Concealed or Surface-Mounted Closers: 12 gauge

4. Glass Moldings and Stops: Loose stops shall be not less than 20 gauge steel, with butt corner joints, secured to frame opening by counterattack screws. Snap-on attachments will not be acceptable.
5. Louvers: Shall be inverted “V” blade, sightproof type, unless noted otherwise.
6. Edge Clearances:
   a. Between Door and Frame at Head and Jambs: 1/8-inch
   b. At Door Sills with No Threshold: 5/8-inch to 3/4-inch above finished floor
   c. At Door Sills with Threshold: As required to suit threshold
   d. Between Meeting Edges of Double Doors: 1/8-inch

C. Finish:
1. Shop Paint Steel (whether galvanized or ungalvanized) Stops and Accessories as follows:
   a. Clean surfaces free of mill scale, rust, oil, grease, dirt and other foreign matter.
   b. Chemically treat surfaces and apply one (1) coat of an approved baked-on rust-inhibitive primer paint to provide a minimum 0.5 mil (0.0127 mm) dry film thickness.
2. Field painted under Section 09 91 00, Painting.

D. Sound Rated Door: STC of 32, measured in accordance with ASTM E413.

PART 3 EXECUTION

3.01 INSTALLATION

A. Separate dissimilar metals. Protect against galvanic action.

B. Frames:
1. Anchorage and Connections: Secure to adjacent construction. Where practical, interior door frames shall be flush with the pull side wall to minimize or eliminate the reveal and allow full 180 degree door swing.
2. Install frames in accordance with manufacturer’s instructions and install labeled frames in accordance with NFPA 80.
3. Frame Spreader Bars: Leave intact until frames are set perfectly square and plumb and anchors are securely attached.
4. Remove hardware, with the exception of prime-coated items, tag box, and reinstall after finish paint work is completed. Do not remove or paint over labels on labeled frames.

C. Doors:
1. Install hardware in accordance with hardware manufacturer’s templates and instructions.
2. Install doors in accordance with manufacturer’s instructions and install labeled doors in accordance with NFPA 80.
3. Adjust operable parts for correct function.
4. Remove hardware, with the exception of prime-coated items, tag, box, and reinstall after finish paint work is completed. Do not remove or paint over labels on labeled doors.

3.02 ADJUST AND CLEAN

A. Adjust doors for proper operation, free from binding or other defects.

B. Clean and restore soiled surfaces.

C. Remove packaging, scraps and debris, and leave site in clean condition.

END OF SECTION 08 11 13

SECTION 08 12 10
INTERIOR ALUMINUM DOORS, DOOR FRAMES, AND STOREFRONT FRAMING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

1.02 SUMMARY

A. Section Includes:
   1. Aluminum door frames for interior use.
   2. Aluminum OfficeFronts framing system for interior use.

B. Related Sections:
   1. Section 08 14 16 – “Flush Wood Doors”.
   2. Section 08 71 00 – “Door Hardware”.
   3. Section 08 80 00 – “Glazing”.

1.03 SUBMITTALS

A. Product Data: Submit for door, sidelight and OfficalFronts frames.
   1. Include information for factory finish, glazing gaskets, accessories and other required components.
   2. Include color charts for finish indicating manufacturer’s standard colors available for selection.

B. Shop Drawings: Submit schedule indicating opening identification number, frame types, dimensions, swing, label, and hardware requirements. Use same reference numbers for openings as Contract Drawings.

C. Include elevations and details indicating frame types, profiles, conditions at openings, methods and locations of anchoring, glazing requirements, hardware locations, and reinforcements for hardware, details of connections to special construction and other custom features.

D. Samples: Submit following:
   1. Samples indicating quality of finish in selected colors on alloys used for Work.
   2. Where normal color and texture variations are expected, include additional samples to show range of such variation.

E. Informational Submittals: Submit manufacturer’s instructions.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Provide aluminum frames, aluminum and glass doors, and accessories produced by a single manufacturer for each type of product indicated.

B. Manufacturer’s Qualifications: Manufacturer shall demonstrate previous experience in manufacturing of interior aluminum door and OfficeFronts framing for a period of not less than 10 years on comparable sized project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver frames and doors in cartons to provide protection during transit and storage at project site.

B. Inspect frames and doors upon delivery for damage.
   1. Repair minor damage to pre-finished products by means as recommended by manufacturer.
   2. Replace frames and doors that cannot be satisfactorily repaired.

C. Store frames and doors at project site under cover and as near as possible to final installation location. Do not use covering material that will cause discoloration of aluminum finish.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not begin installation of frames or doors until area of work and interior is protected from the elements.

B. Maintain temperature and humidity in areas of installation within reasonable limits, as close as possible to final occupancy.

1.07 WARRANTY

A. Warranty against defects in manufacturing of materials for a period of 2 years from date of substantial completion.

B. Warrant framing finish against defects, including cracking, flaking, blistering, peeling, and excessive fading, chalking and non-uniformity in color for a period of 5 years.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND PRODUCTS

A. Manufacturers:
   1. Advanced Architectural Frames
   2. Alpha Aluminum Productsm Inc.
   3. Dual Lock Partition System, Inc.; Avalon International Aluminum
   4. Modulex Products, Inc.
   5. RACO Interior Products, Inc.
   6. Versatrac Frames; a division of America Door Products, Inc.
   7. Western Integrated Materials, Inc.
   8. Wilson Partitions; a division of Arcadia Inc.

B. Basis of Design Product
   1. Interior Door Frames: RACO Classic Prestige fixed throat frames to accommodate wall thickness indicated on Drawings; ceiling height system.
   2. Interior Borrowed Light and OfficeFronts Framing: RACO Classic Prestige fixed throat frames to accommodate wall thickness indicated on Drawings; ceiling height system.

2.02 MATERIALS

A. Aluminum: Meeting requirements of ASTM B221, 6063T5 alloy, and as otherwise required to assure compliance with dimensional tolerances and maintain color uniformity. Billets shall be composed of at least 33% recycled aluminum.

B. Anchorage Devices, Clips and Fasteners: Manufacturer’s standard type, compatible with materials being secured.

C. Accessories: As necessary for complete system.

2.03 EXTRUDED ALUMINUM FRAME AND DOOR FABRICATIONS

A. Assemble all sidelights and windows with the use of clips.

B. Do not exceed maximum size of window or door to meet applicable code requirements.

C. Factory pre-machine door frame jambs and doors and prepare for hardware, with concealed reinforcements plates, drilled and tapped as required, and fastened within frame with concealed screws.

2.04 FINISHES

A. Factory finish extruded frame and door components so that all parts exposed to view upon completion of installation are uniform in finish and color. Exposed surfaces shall be free of scratches and other serious blemishes.

B. Clear Anodized: AA-M12C22A21, etched, medium matte, clear anodic coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine project conditions and verity that project is ready for work of this section to proceed. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify wall thickness does not exceed manufacturer's recommended tolerances of specified throat size.

3.02 INSTALLATION

A. Comply with frame and door manufacturer's printed installation instructions and approved shop drawings. Do not attempt installation in areas where wall thickness exceeds tolerances of specified throat size.

B. Install frames plumb and square, free from warp or twist, securely anchored to substrates with fasteners recommended by frame manufacturer. Maintain dimensional tolerances and alignment with adjacent work. Ensure joints are hairline tight and surfaces flush with adjacent components.

C. Set all doors in correct locations as shown on the drawings, level, square, plumb and in alignment with other work in accordance with the manufacturer's installation instructions and approved shop drawings.

D. Install glass in accordance with Section 08 80 00.

E. Install door hardware in accordance with Section 08 71 00.

3.03 ADJUSTING AND CLEANING

A. Protect exposed portions of aluminum surfaces from damage by plaster, lime, acid, cement, and other contaminants.

B. Touch up marred areas so that tough-up is not visible from a distance of 4 feet (121.92 cm). Remove and replace frames that cannot be satisfactorily adjusted.

3.04 PROTECTION

A. Protect as required to assure that frames and doors will be without damage until Substantial Completion.

END OF SECTION 08 12 10

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

B. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2021, with Errata (2022).

1.02 SUMMARY

A. Section Includes:
   1. Solid-core doors with plastic-laminate faces.
   2. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
   1. Section 08 11 13 “Hollow Metal Doors and Frames” for door frames.
   2. Section 08 71 00 “Door Hardware” for door hardware.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of door.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of blocking.
   2. Dimensions and locations of mortises and holes for hardware.
   3. Dimensions and locations of cutouts.
   4. Undercuts.

C. Samples: For plastic-laminate door faces.

1.04 INFORMATIONAL SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Algoma for flush wood doors or Architects approved equal.
   1. Masonite Architectural
   2. VT Industries
   3. Marshfield
   4. Mohawk

2.02 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI’s, AWMAC’s, “Architectural Woodworking Standards”.
   1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.

B. WDMA I.S. 1A Performance Grade:
   1. Heavy Duty unless otherwise indicated.

C. Structural-Composite-Lumber-Core Doors:
   1. Structural Composite Lumber: WDMA A.S.10.
      a. Screw Withdrawal, Face: 700 lbf.
      b. Screw Withdrawal, Edge: 400 lbf.

2.03 PLASTIC-LAMINATE-FACED DOORS

A. Interior Solid-Core Doors:
   1. Grade: Premium.

2. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
3. Colors, Patterns, and Finishes: As selected by Architect from laminate manufacturer's full range of products.
4. Exposed Vertical Edges: Plastic laminate that matches faces, applied before faces.
5. Core: Structural Composite Lumber
6. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied.

2.04 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.

2.05 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges.

PART 3 EXECUTION

3.01 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware".

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standards, and as indicated.

C. Factory-Fitten Doors: Align in frames for uniform clearance at each edge.

END OF SECTION 08 14 16

SECTION 08 14 23
LAMINATE-FACED WOOD DOORS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

1.02 RELATED WORK

A. Section 08 11 13, Hollow Metal Doors and Frame, for door frames.

B. Section 08 71 00, Finish Hardware

C. Section 08 80 00, Glazed Systems: Vision glazing types for factory glazing.

D. Section 09 91 00, Painting, for painting of glass stops to match door frames.

1.03 REFERENCES

A. Architectural Woodwork Institute (AWI)

B. National Fire Protection Association (NFPA)
   1. 80, Fire Doors and Fire Windows
   2. 252, Fire Tests of Doors Assemblies

C. Underwriters Laboratories (UL)
   1. Building Materials Directory
   2. Listing and Labeling
   3. 10 (c), Fire Tests of Door Assemblies – Positive Pressure

D. Intertek Testing, Services (Warnock Hersey, Inc. (WHI))
   1. Certification Listings for Fire Doors

1.04 SUBMITTALS

A. Product Data:
   1. Manufacturer’s specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer’s installation instructions.

B. Shop Drawings:
   1. Show or schedule location, size, thickness, elevation, details of construction, location and extent of hardware blocking, fire rating, and other pertinent data for each door required.
   2. Include schedule of hardware preparation required for each door.
   3. Indicate requirements for veneer matching.

C. Samples: Plastic laminate in colors and patterns for Architect’s selection.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with AWI Quality Standards, Custom Grade A.

1.06 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00, Project Management and Coordination.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery to site, store, protect, and handle doors in accordance with AWI Quality Standards and manufacturer’s instructions. Accept doors on site in manufacturer’s standard packaging. HVAC systems shall be operating and balanced prior to arrival of doors. Acceptable humidity shall be no less than 25 percent nor greater than 55 percent.

B. Storage:
   1. Store doors in a clean and dry location protected from weather and abuse.
   2. Stabilize moisture content prior to installation.

C. Mark each door on the top or in the top hinge with opening numbers corresponding to approved shop drawings.

1.08 WARRANTY

A. Provide for lifetime replacing, including cost of rehanging and refinishing, at no cost to Owner, wood doors exhibiting defects in materials or workmanship including, but not limited to the following:
   1. Warp in excess of ¼ inch as defined by AWI.
   2. Warp or twist to a degree that door will not operate properly.
   3. Delamination of face.
   4. Telegraphing or show through of stiles, rails, or core greater than 0.01 inch (0.25 mm) in any 3-inch area.

PART 2 PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Manufacturers listed or named in the specifications who produce equivalent products to those specified are approved for use on the Project. Other manufacturer must have a minimum of 5-years experience manufacturing equivalent products to those specified and comply with requirements of Division 1 regarding substitutions to be considered.
   1. Doors:
      a. American Door Products (VT Industries)
      b. Eggers Industries
      c. Ideal Architectural Door & Plywood
      d. Marshfield Doors Systems, Inc.
      e. Oshkosh Architectural Door Company
   2. Plastic Laminate:
      a. Formica Corp.
      b. Nevamar, International Paper, Decorative Products Division
      c. Wilsonart International

2.02 MATERIALS

A. Flush Interior Non-Rated Wood Doors:
   1. General: 3-ply AWI PC-HPDL-3 High Pressure Decorative Laminate (HPDL), Bonded Particle Core, stile and rails abrasively planed as an assembly prior to laminating, factory machine and fit.
   2. Thickness: 1-3/4 inch (44 mm).
   3. Core: 32 lbs per cubic foot particleboard, 1LD2 in accordance with ANSI A208.1
   4. Stile: LSL, 1-3/8 inch (35 mm), bonded to core
   5. Rail: LSL, bonded to core, 1-1/8 inch (29 mm) minimum, 5 inch (127 mm) lead head rail for closer reinforcement.

B. Mineral Core:
   1. Meet applicable requirements of Paragraph A above.
   2. Core: Asbestos-free, incombustible mineral sections – 45, 60, or 90-minute fire-rated, positive pressure Category A.
   3. Stiles and Rails: Manufacturers thickness to achieve rating.

C. Accessories:
   1. Glazing: Factory glaze with glass as indicated. Verify compatibility of glazing system with positive pressure requirements where applicable.
   2. Glass Stops: Glass stops, if any, shall be wood to match door. Stops prepared for countersink style tamper proof screws. Size for 6-inch by 36-inch vision glass, unless noted otherwise. Color will be approved by Architect.
   3. Adhesives: Type 1, hot pressed

4. Hardware Blocking: Providing structural composite lumber or solid lumber as required. Coordinate with hardware as scheduled.
5. Plastic Laminate: 0.050-inch thick, as selected by Architect from manufacturer's full range of colors.
6. Seal top, bottom and cut surface of openings at factory with two (2) coats varnish.
7. Vertical door edges shall be factory painted to match door face. Factory shall supply matching paint and edges shall be touched-up in field.

PART 3 EXECUTION

3.01 INSTALLATION

A. Doors and hardware installed under Section 06 10 00, Rough Carpentry. Follow manufacturer's printed instructions. Coordinate work with door opening construction, and door and frame hardware installation.

B. Clearances:
   1. Head and Jambs: 1/8-inch maximum.
   2. Sill: ½-inch typically, except provide 1/4-inch clearance from top surface of carpeting.

C. Verify that frames comply with indicated requirements for type, size, location and swing characteristics and that the frames are installed plumb, level and parallel. Reject doors with defects that are not repairable.

D. Coordinate hardware installation for proper door operation. Adjust locks and latches to engage snugly without forcing. Align hardware to function without squeaking, binding, or racking. Mortise as required for automatic door bottoms.

E. Protect doors from damage and replace doors that are damaged. Verify that tops and bottoms of doors have been sealed prior to installation, as required for warranty.

3.02 CLEANING AND REPAIRING

A. Clean doors in accordance with manufacturer's instructions.

B. Repair or replace damage doors at no expense to Owner.

END OF SECTION 08 14 23

SECTION 08 31 13
ACCESS DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Access doors in gypsum board, masonry partitions, and plaster/stucco soffits, where shown or required.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's literature, including schedules, charts, and illustrations to indicate the performance, fabrication, procedures, product variations, and accessories.
   2. Manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers listed whose products meet or exceed the specifications are approved for use the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing access doors meeting or exceeding the specifications and comply with Divisions 1 requirements regarding substitutions in order to be considered.
   1. Acudor products, Inc., Cedar Grove, NJ
   2. Babcock-Davis (Cierra Products), Brooklyn Park, MN
   3. Bar-co, Alfab, Inc. Enterprise, AL
   4. J.L. Industries, Incorporated, Bloomington, MN
   5. Karp associates, Inc. Maspeth, NY
   6. Larsen's Manufacturing Company, Minneapolis, MN
   7. Milcor LP, Holland, OH
   8. Nystrom Building Products Co., Inc., Minneapolis, MN
   9. The Williams Brothers Corporation of American, Front Royal, VA

B. Specification are based on products of the Babcock-Davis, Brooklyn Park, MN; (888) 412-3726.

2.02 PRODUCTS

A. General: The following access panel types are for selection as required whether or not indicated on drawings, unless indicated elsewhere in Divisions 22-26. The contractor shall evaluate the specific requirements and provide the appropriate system based on the condition, as all types may not be required on the project. The inclusion of any of the listed access panel types does not necessarily imply that the condition exists in the scope of the work.

B. Standard type flush steel door for exterior masonry construction:
   1. Size: 2-feet 0-inches x 3-feet 0-inches unless otherwise noted in drawings or specifications.
   2. Hinges: Stainless steel concealed continuous piano type hinges.
   3. Frames: 6063-T5 extruded aluminum frame. Mill finish.
   4. Doors: 20 gauge galvanized steel. Phosphate dipped and prime coated for filed painting per Section 09 91 00.
   5. Latch and Lock: Two (2) dual acting handles with exterior lock.
   6. Gasketing: Extruded santoprene.
   7. Insulation: 2-inch thick fiberglass.
   8. Approved Product: Model "B-XT", or architect approved equal.

C. Standard type flush steel door for wallboard and masonry construction:
   1. Size: 2-feet 0-inches x 3-feet 0-inches unless otherwise noted on drawings or specifications.

a. Provide 12-inch x 12-inch access panels at all motorized overhead coiling doors, grilles, and coiling counter doors that are located within non-removable ceilings for access to motors for repairs and maintenance of electric operators.

2. Hinges: Concealed continuous piano type hinges.
3. Finish: Phosphate dipped and prime coated for field painting per Section 09 91 00.
4. Frames: 16 gauge galvanized steel with 22 gauge galvanized wallboard corner bead.
5. Doors: 14 gauge galvanized steel.
6. Lock: Flush screw driver operated cam.
7. Approved Product: Model “B-NW”, or Architect approved equal.

D. Standard type flush steel door for plaster/stucco soffit construction:
1. Size: As shown on drawings.
2. Hinges: Concealed continuous piano type hinges.
3. Finish: Phosphate dipped and prime coated for field painting per Section 09 91 00.
4. Frames: 16 gauge galvanized steel with 22 gauge galvanized plater casing bead.
5. Doors: 14 gauge galvanized steel.
6. Lock: Flush screw driver operated cam.
7. Approved Product: Model “B-NP”, or Architect approved equal.

E. Fire rated flush steel door for wallboard construction:
1. Listing: UL listed ‘B’ label up to 1 1/2-hours in walls and Warnock-Hershey listed up to 3 hours in ceilings.
2. Size: As shown on the drawings.
3. Hinges: Concealed pin hinge.
4. Finish: Phosphate dipped and prime coated for field painting per Section 09 91 00.
5. Frames: 16 gauge galvanized steel with 22 gauge galvanized wallboard corner bead.
6. Doors: 20 gauge galvanized steel.
7. Lock: Knurled knob/key operated latch bolt.
8. Approved Product: Model “B-IW”, or Architect approved equal.

F. Insulated access panel for valve box in exterior masonry wall:
1. Size: 12-inches x 12-inches, or as required for application.
2. Door: 0.060 6063-T5 extruded aluminum.
3. Frame: 0.060 6063-T5 extruded aluminum.
4. Hinge: Stainless steel concealed piano hinge.
5. Latch: Hex head cam latch operable with standard alien wrench.
6. Flange: 0.080 6063-T5 extruded aluminum.
7. Finish: Paint grip.
8. Insulation: Two (2) inch thick fiberglass.
9. Gasket: Extruded Sanoprene.
10. Approved Product: Model “B-XT”, or Architect approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Located and provide panels to the trade that is constructing the material being penetrated.

3.02 LOCATIONS

A. Provide where required by code and where needed to service and maintain equipment.

B. If not shown on the drawings, consult the Architect before locating the finished spaces.

END OF SECTION 08 31 13

SECTION 08 36 00
SECTIONAL OVERHEAD DOORS 904U

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural Series
   1. Aluminum Full View Sectional Overhead Door.
   2. Electrical door operators and controls.
   3. Operating hardware tracks and supports.

1.02 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. DASMA 102 - American National Standard Specifications for Sectional Doors; 2018.

C. NEMA ICS 1 - Industrial Control and Systems: General Requirements; 2022.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

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

1.03 RELATED SECTIONS

A. Section 05500 – Metal Fabrications: Steel frame and supports.

B. Section 06114 – Wood Blocking and Curbing: Rough wood framing and blocking for door opening.

C. Section 07900 – Joint Seals: Perimeter sealant and backup materials.

D. Section 08710 – Door Hardware: Cylinder locks.

E. Section 09900 – Paints and Coatings: Field painting.

F. Section 16130 – Raceway and Boxes: Empty conduit from control station to door operator.

G. Section 16150 – Wiring Connections: Electrical service to door operator.

1.04 REFERENCES

A. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures

B. ANSI / DASMA 102; American National Standard specifications for sectional overhead type doors.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Manufacturer’s data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Installation methods.
   3. Operation and maintenance data.
   4. Nameplate data and ratings for motors.

C. Shop Drawings: Include opening dimensions and required tolerances, connections details, anchorage spacing, hardware locations, and installation details.

D. Manufacturer’s Certificates: Certify products meet or exceed specified requirements.

1.06 WIND PERFORMANCE REQUIREMENTS

A. Design doors to withstand positive and negative wind loads as calculated in accordance with applicable building code and detailed in structural documentation.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of doors specified in this section, with not less than ten years of documented experience.

B. Installer Qualifications: Company specializing in installing the types of products specified in this section, with minimum of five years of documented experience, and approved by the door manufacturer.

1.08 WARRANTY

A. Finish Limited Warranty:
   1. Custom Color Option (RAL Color Blast® Finish) – 10 years
   2. Parts and Hardware – 1 year

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Clopay Corporation

B. Requests for substitutions will be considered prior to bid date in accordance with provisions of Section 01 60 00.

2.02 SECTIONAL OVERHEAD DOOR: 904U

A. 904U: Aluminum Full View Sectional Door, Polyurethane Insulated
   1. Door Size: refer to drawings
   2. Panel Sections: 2-1/8 inches (54 mm) thick extruded 6053-T5 aluminum.
   3. Rails and Stiles: Polyurethane foam injected.
   4. Astragal: U-shaped flexible PVC in retainer of full-length 0.055 inch (1.4 mm) rigid PVC.
   5. U-Factor: 0.86 (with clear insulated glass)
   6. R-Value: 3.8 (with clear insulated glass)
   7. Air Infiltration: 0.15cfm/ft2
   8. Aluminum Finish:
      a. RAL Color Blast® Powder Coat – custom color as selected by Architect.
   9. Windows:
      a. Glazing thickness
         1) ¼ inch 0.12 inch (3 mm)
      b. Glazing type
         1) Low E Coated
      c. Glazing tint
         1) Gray
   10. Locking:
      a. Provide one inside slide lock with interlock.
   11. Weather-stripping: Provide complete perimeter seals. Provide flexible top seal, flexible jamb seal and U-shaped bottom seal.
   12. Track:
      a. Provide track configuration to maximize headroom available per plans.
      b. 3 inches (76.2 mm) track designed for 3” diameter rollers. Vertical and horizontal tracks minimum 0.096 inch (2.44 mm) galvanize steel.
   13. Spring Counterbalance: Torsion spring counterbalance mechanism sized to weight of the door, with high strength galvanized aircraft cable with minimum 7 to 1 safety factory.
      a. High Cycle Spring: 100,000 cycles.

2.03 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator provided by door manufacturer for door with operational life specified complete with electric motor and factory pre-wired motor controls, starter, gear-

reduction unit, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation. Comply with NFPA 70.
1. Solenoid-operated brake

B. Disconnect Device: Provide hand-operated disconnect or mechanism for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

C. Design operator so motor may be removed without disturbing limit switch adjustment and without affecting emergency auxiliary operator.

D. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, AC or DC.

E. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motor, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps 0.22 yard (0.2 meter)/s) and not more than 1 fps (0.03 yard (.03 meter)/s), without exceeding nameplate ratings or considering service factor.
1. Type: Jackshaft.
2. HP:
   a. 3/4hp (559 W).
3. Power Characteristics:
   a. 3 phase.
4. Service Factor:
   a. NEMA MG 4.
5. Coordinate wiring requirements and electrical characteristics of motors with building electrical system.

F. Remote Control Station: Provide momentary contact, 3-button control station with push – button controls labeled “Open”, “Close” and “Stop”.

G. Provide interior units, fully graded, surface mounted, heavy-duty type, with general-purpose NEMA ICS 6 enclosure in one of the following types:
1. Enclosure Type: Type 1

H. Obstruction Detection Device: Provide each motorized door with indicating external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
1. Sensor Edge: Provide each motorized door with an automatic safety sensing edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer’s standard take-up reel or self-coiling cord. Sensing edge shall be operated by:
   a. Electric Fail safe.
2. Photo-electric control: Provide each motorized door with a photo-electric device that will stop and reverse the downward door travel if the light beam is broken or blocked. Device shall be:
   a. NEMA Type 4.
3. Light Curtain: LiftMaster LC-36A light curtains to provide 36” cross-beam infrared detection with integral transmitter and receiver.

I. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

J. Radio Controls: Provide 3 button radio transmitter to provide remote open, close, stop functionality.
1. Provide external antenna and coaxial wiring to receiver to enhance radio control reception.

K. Provide auxiliary chain hoist: for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine wall and overhead areas, including opening framing and blocking, with installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work in this Section.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If substrate preparation is the responsibility of another entity, notify Architect of unsatisfactory preparation before proceeding.

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 overhead doors and track in accordance with approved shop drawings and the manufacturer’s printed instructions.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 08 36 00

SECTION 08 41 13
FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2025.

B. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

G. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube; 2020.

H. ASTM C1401 - Standard Guide for Structural Sealant Glazing; 2023.

I. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.

J. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2023.

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 2023).

1.02 SUMMARY

A. Section Includes:
   1. Exterior storefront framing.
   2. Storefront framing for punched openings.

B. Exterior manual-swing entrance doors and door-frame units.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum-framed entrances, storefronts and punched openings. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

F. Delegated-Design Submittal: For aluminum-framed entrances, storefronts and punched openings indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATION SUBMITTALS

A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

C. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C1401. Include periodic quality-control reports.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranties: For special warranties.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.07 MAINTENANCE DATA FOR STRUCTURAL SEALANT: FOR STRUCTURAL-SEALANT-GLAZED STOREFRONT TO INCLUDE IN MAINTENANCE MANUALS. INCLUDE ASTM C1401 RECOMMENDATIONS FOR POST-INSTALLATION-PHASE QUALITY-CONTROL PROGRAM.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining constructions.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.09 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 41 00 “Regulatory Requirements”, to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformity distributed ad concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

C. Structural Loads:
   1. Wind Loads: Provide entrance and storefront punched opening systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers’ ACSE 7, “Minimum Design Loads for Buildings and Other Structures”, 6.4.2, “Analytical Procedure”, whichever are more stringent.
      a. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch (19.05 mm), whichever is smaller, unless otherwise indicated.
      b. Static-Pressure Test Performance: Provide entrance and storefront punched opening systems that do not evidence material failures, structural destress, failure of operating components to function normally, or permanent deformation of main frame members exceeding 0.2 percent of clear span when testing according to ASTM E330.
         1) Test Pressure: 150 percent of inward and outward wind-load design pressures.
         2) Duration: As required by design wind velocity: Fastest 1 mile (1.61 kilometer) of wind for relevant exposure category.
   2. Dead Loads: Provide entrance-and storefront punch opening system members that do not deflect an amount that will reduce glazing bite below 75 percent of design dimension when carrying full dead load.
      a. Provide a minimum 1/8-inch clearance between members and top of glazing or other fixed part immediately below.
      b. Provide a minimum 1/16-inch clearance between members and operable doors.
   3. List Loads: Provide entrance and storefront punched opening systems, including anchorage, that accommodate the supporting structures’ deflection and uniformly distributed and concentrated live loads indicated without failure of materials or permanent deformation.

D. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area:
   a. Maximum air leakage of at a static-air-pressure differential of 1.57 lbf/sq. ft.
2. Entrance Doors:
   a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
   b. Single Doors: Maximum air leakage of 0.5 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.

E. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq.ft.

2.02 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Trifab VG 451T for storefront punched opening and exterior entrance frame units or comparable product by one of the following:
1. EFCO Corporation.
2. Pittco Architectural Metals, Inc.
3. YKK AP America, Inc.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.03 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center Glazed.
4. Finish: To be chosen from full range of Manufacturer options.
5. Fabrication Method: Field-fabricated stick system.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   a. Sheet and Plate: ASTM B 209.
   b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
   c. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
   d. Structural Profiles: ASTM B308/B308M.
2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.04 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Doors Design: Medium stile; 3-1/2-inch nominal width.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
   a. Provide nonremovable glazing stops on outside of door.

2.05 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 “Door Hardware”.

2.06 GLAZING

A. Glazing: Comply with Section 08 80 00 “Glazing”.

2.07 ACCESSORIES

A. Fasteners and Accessories: Manufacturer’s standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforcing members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.

2.08 ANCHORS: THREE-WAY ADJUSTABLE ANCHORS WITH MINIMUM ADJUSTMENT OF 1 INCH (25.4 MM) THAT ACCOMMODATE FABRICATION AND INSTALLATION TOLERANCES IN MATERIAL AND FINISH COMPATIBLE WITH ADJOINING MATERIALS AND RECOMMENDED BY MANUFACTURER.

   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

B. Concealed Flashing: Manufacturer’s standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

2.09 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal insolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior.
   6. Fasteners, anchors, and connections devices that are concealed from view to greatest extent possible.

D. Mechanically Glazing Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, providing sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation Factory cut, drill, and tap for installation of entrance door hardware.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Black Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0 inch (0.02 mm) or thicker.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.03 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.

B. Fit joints to produce hairline joints free of burrs and distortion.
   1. Rigidly secure nonmovement joints.
   2. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   3. Seal perimeter and other joints watertight unless otherwise indicated.

C. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete, protect against corrosion by painting contact surfaces with bituminous paint.

D. Set continuous sill members and flashing in full sealant bed as specified in Section 07 92 00 "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades.

F. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

G. Install glazing as specified in Section 08 80 00 "Glazing".

H. Install weatherseal sealant according to Section 07 92 00 "Joint Sealant" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

I. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturer's written instructions using concealed fasteners to greatest extent possible.

3.04 ERECTION TOLERANCES

A. Erection Tolerance: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch (3.18 mm) in 10 feet (304.8 cm); ¼ inch in 40 feet (1219.2 cm).
   2. Level: 1/8 inch (3.18 mm) in 20 feet (609.6 cm); ¼ inch in 40 feet (1219.2 cm).

3. Alignment:
    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.59 mm).
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.18 mm).
    c. Where surfaces are separated be reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6.35 mm).
4. Location: Limit variation from plane to 1/8 inch (3.18 mm) in 1/2 feet (15.24 cm); 1/2 inch (12.7 mm) over total length.

3.05 FIELD QUALITY CONTROL

A. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts.

B. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.
    a. Perform a minimum of two tests in areas as directed by Architect.

C. Aluminum-framed entrances and storefronts will be considered defective in they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.06 MAINTENANCE SERVICE

A. Entrance Door Hardware:
1. 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 entrance door hardware.

END OF SECTION 08 41 13

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
   a. "Metal Doors and Frames"
   b. "Flush Wood Doors"
   c. "Stile and Rail Wood Doors"
   d. "Interior Aluminum Doors and Frames"
   e. "Aluminum-Framed Entrances and Storefronts"
   f. "Stainless Steel Doors and Frames"
   g. "Special Function Doors"
   h. "Entrances"
6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:
      1) Door Index: door number, heading number, and Architect's hardware set number.
      2) Quantity, type, style, function, size, and finish of each hardware item.
      3) Name and manufacturer of each item.
      4) Fastenings and other pertinent information.
      5) Location of each hardware set cross-referenced to indications on Drawings.
      6) Explanation of all abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for hardware.
      8) Door and frame sizes and materials.
      9) Degree of door swing and handing.
      10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:
   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:

1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
2. Provide Product Data:
   a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
   b. Include warranties for specified door hardware.

D. Closeout Submittals:

1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
   a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
   b. Catalog pages for each product.
   c. Final approved hardware schedule edited to reflect conditions as installed.
   d. Final keying schedule

e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:

1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
   a. Fire door assemblies, in compliance with NFPA 80.
   b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
   a. For door hardware: DHI certified AHC or DHC.
   b. Can provide installation and technical data to Architect and other related subcontractors.
   c. Can inspect and verify components are in working order upon completion of installation.
   d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.

4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

1. Fire-Rated Door Openings:
   a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
   b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

2. Smoke and Draft Control Door Assemblies:
   a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105

b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

3. Electrified Door Hardware
   a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

4. Accessibility Requirements:
   a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
   a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
      1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
      2) Preliminary key system schematic diagram.
      3) Requirements for key control system.
      4) Requirements for access control.
      5) Address for delivery of keys.

2. Pre-installation Conference
   a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   b. Inspect and discuss preparatory work performed by other trades.
   c. Inspect and discuss electrical roughing-in for electrified door hardware.
   d. Review sequence of operation for each type of electrified door hardware.
   e. Review required testing, inspecting, and certifying procedures.
   f. Review questions or concerns related to proper installation and adjustment of door hardware.

3. Electrified Hardware Coordination Conference:
   a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.

1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."

1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.

B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.

C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication

1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer’s recognized installation standards for application intended.
2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with “Metal Doors and Frames”, “Flush Wood Doors”, “Stile and Rail Wood Doors” to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Ives 5BB series

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.

3. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
4. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
5. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
   a. Steel Hinges: Steel pins
   b. Non-Ferrous Hinges: Stainless steel pins
   c. Out-Swinging Exterior Doors: Non-removable pins
   d. Out-Swinging Interior Lockable Doors: Non-removable pins
   e. Interior Non-lockable Doors: Non-rising pins

6. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

B. Requirements:

1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
   a. Von Duprin EPT-10

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 MORTISE LOCKS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage L9000 series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to “KEYING” article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified and motor based latch retraction locksets that comply with the following requirements:
   a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
   b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
   c. Low maximum current draw – maximum 0.4 amps (Lever control) and maximum 2.0 amps (Latch retraction) to allow for multiple locks on a single power supply.
   d. Low holding current (Lever control or latch retraction) – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications and motorized latch retraction applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
   e. Connections – provide quick-connect Molex system standard.
8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
   a. Lever Design: 17A.

2.07 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Von Duprin 99/33A series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.

3. Provide grooved touchpad type exit devices, fabricated from brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match the balance of door hardware.
4. Touchpad must extend a minimum of one-half of the door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with a deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices at pool gates with weather-resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturers' approved strikes.
9. Provide exit devices cut to the door width and height. Install exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Architect.
10. Mount the mechanism case flush on the face of the doors or provide spacers to fill gaps behind the devices. Where glass trim or molding projects off the face of the door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non-fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide a type that can be removed by use of a keyed cylinder, which is self-locking when reinstalled.
13. Provide factory-drilled weep holes for exit devices used in full exterior applications, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors, eliminating the requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.
    a. Provide levers that return to within 1/2 inch (13 mm) of the door face.

17. Provide exit devices with PA filler.
18. Accessibility: Require not more than 5 lb. to retract the latchbolt, per CBC 2019 11B-404.2.7 and 11B-309.4.
    a. Mechanical method: Von Duprin AX feature, where touchpad directly retracts the latchbolt with 5 lb. or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb. requirement.
    b. Electrical method: Von Duprin's RX-QEL feature, where lightly pressing the touchpad with 5 lb. or less of force closes an electric switch, activating quiet electric latch retraction.

2.08 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Von Duprin 99/33A Series Outdoor Defense

B. Requirements:

1. Exit device must be designed to perform in outdoor conditions, and engineered to safeguard against moisture, temperature variations, and corrosion.
2. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.

3. Provide Outdoor Defense exit devices for use in full exterior application, highly corrosive areas, and where noted in hardware sets.
4. Provide Outdoor Defense exit devices in Rim, Surface Vertical Rod, and Concealed Vertical Rod configuration.
5. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware[LE1] .
6. Cylinders: Refer to “KEYING” article, herein.
7. Provide smooth or touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
8. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
9. Provide exit devices with dead-latching feature for security and for future addition of alarm kits and/or other electrified requirements.
10. Provide flush end caps for exit devices.
11. Provide exit devices with manufacturers’ approved strikes.
12. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
13. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
14. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
15. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
16. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
17. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

C. Outdoor Defense Features:

1. Designed to perform in a variety of outdoor conditions and utilize a series of tests to ensure performance as intended in outdoor applications.
   a. Temperature range: -31 degrees Fahrenheit (-35 degrees Celsius) to 151 degrees Fahrenheit (66 degrees Celsius).
      1) Evaluated per UL294 Section 81 Variable Ambient Test
      2) Evaluated per UL1034 Section 34.2 Variable Ambient Test
   b. Moisture Resistance: Rain tested at 4.8 gallons per minute
      1) Per UL294 Section 79
      2) Per UL1034 Section 53
   c. Corrosion Resistance: Salt Fog Tested per
      1) UL294 Section 83.2 Salt Spray (5% salt concentration)
      2) UL1034 Section 52 Salt Spray Corrosion Test (20% salt concentration)
   d. Dust Resistance: Dust Tested per
      1) UL294 Section 80 Dust Test
      2) UL1034 Section 54 Dust Test

D. Electrified Options (provide as scheduled):

1. Electrified options must be engineered to perform in outdoor conditions and must be warrantied for humidity, rain, and temperature.
   a. CX: Provide delayed egress devices, where scheduled, that are UL 294 listed, meet National Fire Protection Association (NFPA) and International Building Code (IBC) governing delayed egress, and/or other local and national fire codes acceptable to authority having jurisdiction as required.

1) Provide non-handed and field sizable device with 3/4 (19mm) throw deadlocking latch bolt. Device incorporates an internal RX switch that detects attempt to exit from applying less than 15lbs to the push pad, which causes this switch to start an irreversible alarm cycle. Key switch in device is capable of arming, disarming, or resetting the device; and indicator lamp determines status of the device
2) Provide devices capable of standard 15 second release delay and indefinite release delay as required by code, when tied into fire alarm system will release immediately when an alarm condition exists.
3) Provide devices with all control inputs – door position input, external inhibit input, fire alarm input; auxiliary locking; nuisance alarm and internal horn; and, remote signaling output self-contained in the device assembly.

b. QEL Option, quiet electric latch retraction
c. ALK Option, alarm kit
d. LX Option, latch bolt monitoring
e. RX Option, request to exit switch
f. WH Option, weep holes

2.09 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage/Von Duprin PS900 Series

B. Requirements:

1. Provide power supplies approved by manufacturer of supplied electrified hardware.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Provide power supplies with the following features:
   a. 12/24 VDC Output, field selectable.
   b. Class 2 Rated power limited output.
   c. Universal 120-240 VAC input.
   d. Low voltage DC, regulated and filtered.
   e. Polarized connector for distribution boards.
   f. Fused primary input.
   g. AC input and DC output monitoring circuit w/LED indicators.
   h. Cover mounted AC Input indication.
   i. Tested and certified to meet UL294.
   j. NEMA 1 enclosure.
   k. Hinged cover w/lock down screws.
   l. High voltage protective cover.

2.10 CYLINDERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. Schlage Everest 29 S

B. Requirements:

1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
   a. Patented Open: cylinder with permanent core with open keyway.
   b. Patented Open: cylinder with interchangeable core with open keyway.
3. Patent Protection: Cylinders/cores requiring use of restricted, patented keys, patent protected.
4. Nickel silver bottom pins.

2.11 KEYING

A. Scheduled System:

1. New factory registered system:
   a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
2. Existing factory registered system:
   a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
3. Existing non-factory registered system:
   a. Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:
      1) Firm Name:
      2) Contact Person:
      3) Telephone:

B. Requirements:

1. Construction Keying:
   a. Replaceable Construction Cores.
      1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
         a) 3 construction control keys
         b) 12 construction change (day) keys.
      2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
2. Permanent Keying:
   a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
      1) Master Keying system as directed by the Owner.
   b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
   c. Provide keys with the following features:
      1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
      2) Patent Protection: Keys and blanks protected by one or more utility patent(s).

3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.

d. Identification:
   1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
   2) Identification stamping provisions must be approved by the Architect and Owner.
   3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
   4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
   5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

e. Quantity: Furnish in the following quantities.
   1) Permanent Control Keys: 3.
   2) Master Keys: 6.
   3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
   4) Key Blanks: Quantity as determined in the keying meeting.

2.12 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Telkee

2. Acceptable Manufacturers:
   a. No Substitute
   b. HPC
   c. Lund

B. Requirements:

1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
   a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
   b. Provide hinged-panel type cabinet for wall mounting.

2.13 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
   a. LCN 4040XP series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
11. Closers shall be capable of being upgraded by adding modular mechanical or electronic components in the field.

2.14 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.15 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

B. Requirements:

1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.

3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
   a. Glynn-Johnson

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.17 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.18 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Ives

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.19 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

B. Scheduled Manufacturer:

1. Zero International

C. Seals and Gasketing: Provide continuous gasketing on exterior openings, to the head and jambs, forming a continuous seal between the door and the frame. Provide smoke, light, or sound gasketing on interior doors where indicated.

1. Provide self-tapping fasteners for aluminum extruded gasketing being applied to hollow metal frames.
   a. Provide non-corrosive fasteners for all exterior applications.
   b. Provide security fasteners where indicated.

2. Provide neoprene, EPDM, silicone, or nylon brush inserts as specified in hardware sets. Provide non brush inserts of solid or sponge cell, as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.

D. Smoke Labeled Gasketing: At all smoke labeled openings, provide smoke listed perimeter gasketing assemblies complying with NFPA 105 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.

E. Fire Listed Gasketing: Assemblies complying with NFPA 80 that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction for fire ratings indicated based on testing according to UL-10C.

1. Where frame-applied intumescent seals are required by the manufacturer, provide gaskets that comply with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies and UBC 7-2, Fire Tests of Door Assemblies.

F. Sound-Rated Gasketing: Provide acoustic gasketing to meet Sound Transmission Class (STC) rating required.

G. Meeting-Stile Gasketing: Provide meeting-stile gasketing that fastens to the meeting stiles forming a continuous seal when doors are closed.

H. Door Sweeps or Shoes: Apply to the bottom of the door to close the gap between the door bottom and finished floor or saddle threshold.

1. Provide solid neoprene, EPDM, silicone, or nylon brush type of seal as specified in hardware sets. Vinyl inserts are not allowed except where specified in hardware sets.

I. Automatic Door Bottoms:

1. Provide closed cell sponge, bulb neoprene. or EPDM type of seal as specified in hardware sets.
2. Door bottom to be mortised, semi mortised, or surface mount as with a minimum thickness as specified in hardware sets.

J. Rain Drips:

1. Provide overhead rain drips for out-swinging hollow metal doors that are not covered against 45 degree blowing rain. Aluminum extrusion to be a minimum of .088 inches thick and extend 2.50 inches from the face of the frame, in anodized finish to match door.
2. Door sweeps or shoes with integral rain drip must meet ADA requirements

K. Thresholds: Provide threshold units not less than 4 inches wide, formed to accommodate change in floor elevation where indicated, and fabricated to accommodate door hardware and fit door frames.

1. Threshold extrusion to be a minimum thickness as specified in hardware sets.

2.20 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Schlage

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.21 BARN DOOR HARDWARE

A. Manufacturers:

1. Scheduled Manufacturer:
   a. Schlage
   b. KN Crowder

B. Requirements:

1. Provide complete sets of sliding door hardware as recommended by manufacturer for door type and weight.
   a. Include track, channels, brackets, hangers, fasteners, guides, pulls, stops, and other hardware as required for complete installation.

2.22 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:

1. Install construction cores to secure building and areas during construction period.
2. Replace construction cores with permanent cores as indicated in keying section.
3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.

4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.

M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

P. Thresholds:

1. Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
2. Aluminum thresholds to be cut-in, and scribed around mullions, frame members, and stops. Do not butt to thresholds. Provide a continuous surface across full width of opening from jamb to jamb.
3. Where aluminum panic-type (rabbeted) thresholds with neoprene inserts are specified, undercut doors as required to properly mate with seal in threshold.

Q. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

R. Perimeter Gasketing:

1. Apply to head and jamb, forming seal between door and frame.
2. Install gasketing in a manner eliminating need to cut any seal to install surface mounted hardware. Install compatible mounting bracket for surface mounted hardware unless minimum 1/4 inch thick solid aluminum seals are provided for mounting of surface applied hardware.

S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 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.

1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to 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.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

150683 OPT0480723 Version 1

Legend:
Link to catalog cut sheet
Electrified Opening

Hardware Group No. 001

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	MORTISE CYLINDER	20-061 ICX W/KEYED CONST. CORE (AS REQ)		626	SCH
1	EA	FSIC PERMANENT CORE	23-030 (AS REQ)		626	SCH
		NOTE	BALANCE OF HARDWARE BY DOOR Mfr			

-COORDINATE HARDWARE REQUIREMENTS WITH DOOR MANUFACTURER PRIOR TO SUBMITTALS.
-REMOVE CYLINDER AND CORE IF NOT REQUIRED.

Hardware Group No. 103

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050T 17A L583-363		626	SCH
1	EA	FSIC PERMANENT CORE	23-030		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

Hardware Group No. 201SW

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080T 17A		626	SCH
1	EA	FSIC PERMANENT CORE	23-030		626	SCH
1	EA	OVERHEAD STOP	100S SERIES X SIZE & MOUNTING AS REQ		US32D	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA TBWMS X MTG BRKT, SPCR & PLATE AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

Hardware Group No. 203

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080T 17A		626	SCH
1	EA	FSIC PERMANENT CORE	23-030		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

Hardware Group No. 203S

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	L9080T 17A		626	SCH
1	EA	FSIC PERMANENT CORE	23-030		626	SCH
1	EA	OVERHEAD STOP	100S SERIES X SIZE & MOUNTING AS REQ		US32D	GLY
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

Hardware Group No. 303

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK	L9040 17A L583-363		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

Hardware Group No. 341

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	L9040 17A L583-363 OS-OCC		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBWMS X MTG BRKT, SPCR & PLATE AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

-OCCUPIED/VACANT INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 347

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	L9040 17A L583-363 OS-OCC		626	SCH
1	EA	OVERHEAD STOP	100S SERIES X SIZE & MOUNTING AS REQ		US32D	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA TBWMS X MTG BRKT, SPCR & PLATE AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

-OCCUPIED/VACANT INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 401

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	L9010 17A		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBWMS X MTG BRKT, SPCR & PLATE AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

Hardware Group No. 403

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	L9010 17A		626	SCH
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

Hardware Group No. 501C

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	L9070T 17A		626	SCH
1	EA	FSIC PERMANENT CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBWMS X MTG BRKT, SPCR & PLATE AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)		BK	ZER

Hardware Group No. 715.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	PANIC HARDWARE	99-NL-SNB		626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE		626	SCH
1	EA	FSIC PERMANENT CORE	23-030		626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBWMS X MTG BRKT, SPCR & PLATE AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA DOOR WIDTH + 4" (OMIT @ COVERED OPENINGS)		AA	ZER
1	SET	GASKETING	328AA HEAD & JAMBS		AA	ZER
1	EA	DOOR SWEEP	8198AA		AA	ZER
1	EA	THRESHOLD	65A		A	ZER
1	EA	KNOX BOX	KNOX BOX			KNO

Hardware Group No. 731

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PANIC HARDWARE	99-L-BE-17-SNB		626	VON
1	EA	SURFACE CLOSER	4040XP RW/PA TBWMS X MTG BRKT, SPCR & PLATE AS REQ		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 902

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	KN CROWDER BARN DOOR SYSTEM	CFT-201 X (TRACK LENGTH) 2DR KIT FOR 1-3/4" DOORS		630	KNC
2	EA	LONG DOOR PULL	(1 SET) PR 9266F 18" (MOUNT BACK TO BACK)		630	IVE

HARDWARE SET IS A GUIDELINE
-VERIFY AND COORDINATE ALL HARDWARE WITH DOOR/FRAME MANUFACTURER PRIOR TO SUBMITTALS.
-CONFIRM TRACK CAN SUPPORT DOOR WEIGHT AND SIZE.
-PROVIDE STOP IN TRACK TO KEEP DOOR 4" INTO OPENING WHEN IN FULLY OPEN POSITION.
-ENSURE 32" OF CLEAR WIDTH IS MAINTAINED IN OPENING.

Hardware Group No. 903

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	BARN DOOR SYSTEM	SD10 X 6.6/8.0 AS REQ X J STRAP		630	SCH
1	EA	LONG DOOR PULL	(1 SET) PR 9266F 18" (MOUNT BACK TO BACK)		630	IVE

HARDWARE SET IS A GUIDELINE
-VERIFY AND COORDINATE ALL HARDWARE WITH DOOR/FRAME MANUFACTURER PRIOR TO SUBMITTALS.
-CONFIRM TRACK CAN SUPPORT DOOR WEIGHT AND SIZE.
-PROVIDE STOP IN TRACK TO KEEP DOOR 4" INTO OPENING WHEN IN FULLY OPEN POSITION.
-ENSURE 32" OF CLEAR WIDTH IS MAINTAINED IN OPENING.

Hardware Group No. 923

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	POCKET DR FRAME	TYPE C (2-0 TO 3-0 & 6-8 TO 7-0)			KNC
1	EA	RECTANGULAR FLUSH PULL - CONCEALED FASTENERS	CS2002		US32D	ACC

HARDWARE SET IS A GUIDELINE
-VERIFY AND COORDINATE ALL HARDWARE WITH DOOR/FRAME MANUFACTURER PRIOR TO SUBMITTALS.
-CONFIRM TRACK CAN SUPPORT DOOR WEIGHT AND SIZE.

-PROVIDE STOP IN TRACK TO KEEP DOOR 4" INTO OPENING WHEN IN FULLY OPEN POSITION.
-ENSURE 32" OF CLEAR WIDTH IS MAINTAINED IN OPENING.

Hardware Group No. C201

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5			652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8			652	IVE
1	EA	EU MORTISE LOCK	L9092T EU 17A RX CON (FAIL SECURE)			626	SCH
1	EA	FSIC PERMANENT CORE	23-030			626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBWMS X MTG BRKT, SPCR & PLATE AS REQ			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CCV			630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS (USE SILENCERS @ NON-RATED DOORS)			BK	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ				SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS				SCH
1	EA	CREDENTIAL READER	AS SPECIFIED IN DIVISION 28				UNK
1	EA	DOOR CONTACT	679-05 TYPE AS REQ			BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)			LGR	SCE

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY LEVER.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.
-OMIT POWER SUPPLY WHERE PROVIDED BY SECURITY.

Hardware Group No. C711A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	112XY EPT			628	IVE
1	EA	POWER TRANSFER	EPT10 CON			689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-33A-NL-OP-CON			626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE			626	SCH
1	EA	FSIC PERMANENT CORE	23-030			626	SCH
1	EA	90 DEG OFFSET PULL	8190-O 10"			630	IVE
1	EA	SURFACE CLOSER	4040XP RW/PA TBWMS X MTG BRKT, SPCR & PLATE AS REQ			689	LCN
1	EA	WALL STOP	WS406/407CCV			630	IVE
1	SET	SEAL	PERIMETER SEAL BY FRAME MFR				
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ				SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS				SCH
1	EA	CREDENTIAL READER	AS SPECIFIED IN DIVISION 28				UNK
1	EA	DOOR CONTACT	679-05 TYPE AS REQ			BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)				VON

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PUSH PAD.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.
-OMIT POWER SUPPLY WHERE PROVIDED BY SECURITY.

Hardware Group No. C711CGR

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5			652	IVE
1	EA	POWER TRANSFER	EPT10 CON			689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-QEL-99-L-NL-F-17-CON-SNB			626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE			626	SCH
1	EA	FSIC PERMANENT CORE	23-030			626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBWMS X MTG BRKT, SPCR & PLATE AS REQ			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS			BK	ZER
1	EA	DOOR SWEEP	39A			A	ZER
1	EA	THRESHOLD	544A			A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ				SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS				SCH
1	EA	CREDENTIAL READER	AS SPECIFIED IN DIVISION 28				UNK
1	EA	DOOR CONTACT	679-05 TYPE AS REQ			BLK	SCE
1	EA	POWER SUPPLY	PS902 900-FA 900-2RS 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)				VON

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PUSH PAD.
-WIRE THE ELECTRIFIED LATCH BOLT TO THE FIRE ALARM SYSTEM.
-THE ELECTRIFIED LATCH BOLT IS TO REMAIN IN THE EXTENDED POSITION UPON ACTIVATION OF THE FIRE ALARM SYSTEM, UNLESS MANUALLY RETRACTED BY THE PUSH PAD OR BY KEY OVERRIDE.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.
-OMIT POWER SUPPLY WHERE PROVIDED BY SECURITY.

Hardware Group No. C711GR

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5			652	IVE
1	EA	POWER TRANSFER	EPT10 CON			689	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-QEL-99-L-NL-F-17-CON-SNB			626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE			626	SCH
1	EA	FSIC PERMANENT CORE	23-030			626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA TBWMS X MTG BRKT, SPCR & PLATE AS REQ			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	WALL STOP	WS406/407CCV			630	IVE
1	EA	GASKETING	488S PSA HEAD & JAMBS			BK	ZER
1	EA	DOOR SWEEP	39A			A	ZER
1	EA	THRESHOLD	544A			A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ				SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS				SCH
1	EA	CREDENTIAL READER	AS SPECIFIED IN DIVISION 28				UNK
1	EA	DOOR CONTACT	679-05 TYPE AS REQ			BLK	SCE
1	EA	POWER SUPPLY	PS902 900-FA 900-2RS 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)				VON

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PUSH PAD.
-WIRE THE ELECTRIFIED LATCH BOLT TO THE FIRE ALARM SYSTEM.
-THE ELECTRIFIED LATCH BOLT IS TO REMAIN IN THE EXTENDED POSITION UPON ACTIVATION OF THE FIRE ALARM SYSTEM, UNLESS MANUALLY RETRACTED BY THE PUSH PAD OR BY KEY OVERRIDE.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.
-OMIT POWER SUPPLY WHERE PROVIDED BY SECURITY.

Hardware Group No. C714A

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	CONT. HINGE	112XY EPT		628	IVE
2	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-3347A-EO-CON		626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-3347A-NL-OP-CON		626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE		626	SCH
1	EA	FSIC PERMANENT CORE	23-030		626	SCH
2	EA	90 DEG OFFSET PULL	8190-O 10"		630	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH TBWMS X MTG BRKT, SPCR & PLATE AS REQ		689	LCN
1	EA	RAIN DRIP	142AA DOOR WIDTH + 4" (OMIT @ COVERED OPENINGS)		AA	ZER
1	SET	SEAL	PERIMETER SEAL BY FRAME MFR			
1	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR			
2	EA	DOOR SWEEP	8198AA		AA	ZER
1	EA	THRESHOLD	65A		A	ZER
2	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ			SCH
2	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS			SCH
1	EA	CREDENTIAL READER	AS SPECIFIED IN DIVISION 28			UNK
2	EA	DOOR CONTACT	679-05 TYPE AS REQ		BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)			VON

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PUSH PADS.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.
-OMIT POWER SUPPLY WHERE PROVIDED BY SECURITY.

Hardware Group No. C715

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP			630	IVE
1	EA	POWER TRANSFER	EPT10 CON			689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-CON-SNB			626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE			626	SCH
1	EA	FSIC PERMANENT CORE	23-030			626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH TBWMS X MTG BRKT, SPCR & PLATE AS REQ			689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS			630	IVE
1	EA	RAIN DRIP	142AA DOOR WIDTH + 4" (OMIT @ COVERED OPENINGS)			AA	ZER
1	SET	GASKETING	328AA HEAD & JAMBS			AA	ZER
1	EA	DOOR SWEEP	8198AA			AA	ZER
1	EA	THRESHOLD	65A			A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ				SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS				SCH
1	EA	CREDENTIAL READER	AS SPECIFIED IN DIVISION 28				UNK
1	EA	DOOR CONTACT	679-05 TYPE AS REQ			BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)				VON

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PUSH PAD.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.
-OMIT POWER SUPPLY WHERE PROVIDED BY SECURITY.

Hardware Group No. C715A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	CONT. HINGE	112XY EPT			628	IVE
1	EA	POWER TRANSFER	EPT10 CON			689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-33A-NL-OP-CON			626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE			626	SCH
1	EA	FSIC PERMANENT CORE	23-030			626	SCH
1	EA	90 DEG OFFSET PULL	8190-O 10"			630	IVE
1	EA	SURFACE CLOSER	4040XP SCUSH TBWMS X MTG BRKT, SPCR & PLATE AS REQ			689	LCN
1	EA	RAIN DRIP	142AA DOOR WIDTH + 4" (OMIT @ COVERED OPENINGS)			AA	ZER
1	SET	SEAL	PERIMETER SEAL BY FRAME MFR				
1	EA	DOOR SWEEP	8198AA			AA	ZER
1	EA	THRESHOLD	65A			A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ				SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS				SCH
1	EA	CREDENTIAL READER	AS SPECIFIED IN DIVISION 28				UNK
1	EA	DOOR CONTACT	679-05 TYPE AS REQ			BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)				VON

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PUSH PAD.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.
-OMIT POWER SUPPLY WHERE PROVIDED BY SECURITY.

Hardware Group No. JK715X.1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	SET	GATE HINGE/CLOSER	MAMMOTH 180 HINGE & CLOSER W/DINO BOTTOM HINGE (SUPPORTS UP TO 330LBS)			LOX
1	EA	PANIC HARDWARE	OUT-99-NL-WH-SNB		626	VON
1	EA	STANDALONE ELECTRONIC ACCESS PANIC DEVICE TRIM	ETDL-R-26D V99		626	ALA
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE		626	SCH
1	EA	FSIC PERMANENT CORE	23-030		626	SCH
		NOTE	BALANCE OF HARDWARE BY GATE MFR			
1	EA	KNOX BOX	KNOX BOX			KNO

HARDWARE SET IS A GUIDELINE
-VERIFY AND COORDINATE ALL HARDWARE WITH DOOR/FRAME MANUFACTURER PRIOR TO SUBMITTALS.
-ALL REMAINING HARDWARE BY GATE MFR.
-1EA 3/4” MOUNTING PLATE FOR EXIT DEVICE.
-PROVIDE PLATE OR MESH ON GATE TO PREVENT INDIVIDUALS FROM REACHING IN AND OPENING THE GATE FROM SECURE SIDE.
-FREE EGRESS BY THE PUSH PAD.

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Door#	HwSet#
100A	C714A
100B	C711A
101A	341
102A	403
103A	715.1
104A	103
105A	303
106A	103
107A	401
108A	923
109A	C715A
110A	C715A
111A	903
112A	903
113A	903
114A	203
115A	C201
116A	347
117A	303
117B	923
118A	303
118B	923
119A	303
120A	303
121A	403
122A	731
122B	C711CGR
123A	303
124A	303
125A	347
126A	731
126B	C711GR
126D	JK715X.1
127A	347
128A	303
129A	303
130A	303
131A	303
132A	303
133A	303
134A	347
135A	C715A
135B	C715A
136A	902

Door#	HwSet#
137A	501C
138A	401
138N	001
138P	201SW
138T	C201
139A	001
139B	001
139C	001
139D	001
139E	001
139F	001
139G	001
139H	001
139I	001
139O	C715
139P	
139R	C715
141A	203S

END OF SECTION 08 71 00

SECTION 08 80 00
GLAZED SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior and interior glass.
B. Glazing Sealant.
C. Aluminum framing systems.
D. Aluminum and glass entry doors.
E. Glazing of hollow metal doors.
F. Glazing of wood doors.
G. Glazing of plastic laminate faced wood doors.

1.02 REFERENCE STANDARDS

A. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2021.
B. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.
C. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
D. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2026.
E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
G. ASTM C509 - Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material; 2006 (Reapproved 2021).
H. ASTM C1036 - Standard Specification for Flat Glass; 2025.
I. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).
J. 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).
K. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Difference; 2000 (Reapproved 2024).
L. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).

1.03 RELATED WORK

A. Section 08 11 13, Hollow Metal Doors and Frames
B. Section 08 14 23.16, Plastic-Laminate-Faced Wood Doors
C. Section 08 71 00, Finish Hardware
D. Section 07 92 00, Building Sealants

1.04 REFERENCES

A. American Architectural Manufacturers Association
   1. AAMA CW-10, Care and Handling of Architectural Aluminum from Shop to Site
   2. AAMA/NWWDA 101.I.S.2, Voluntary Specification for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

3. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum

B. American National Standards Institute (ANSI)
1. Z97.1, Safety Performance Specification
2. Z97.1, Safety Glass Code

C. ASTM International (ASTM)
1. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickle Steel Plate, Sheet, and Strip
2. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
3. B210, Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
4. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
5. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
6. C509, Standard Specification for Cellular Elastomeric Preformed Gasket and Sealing Material
7. C1036, Standard Specification for Flat Glass
8. 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
9. E330, Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
10. E331, Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Differential
11. E547, Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential

D. American Welding Society (AWS)

E. Federal Specification (FS)
1. DD-G-001403 B
2. T-G-410, Sash putty
3. TT-C-494, Bituminous Paint
4. TT-S-00230, Sealing Compound: Synthetic Rubber Base and TT-S-00203C
5. TT-S-001657, Sealing Compound: Butyl Rubber Base
6. SS-C-153, Mastic Bulk Compound

F. Flat Glass Marketing Association (FGMA)
1. Glazing Sealing Systems Manual
2. Glazing Manual

1.05 SUBMITTALS

A. Shop Drawings: Complete shop drawings by manufacturer indicating elevations, sections, substrates, fasteners, finishes, hardware and installation details.

B. Manufacturer’s specifications and other data needed to prove compliance with specified requirements, and manufacturer’s installation instructions.

C. Engineer’s calculations of performance requirements.

D. Product Data: Manufacturer’s specifications and test reports from an AAMA-accredited laboratory.

E. Samples: Showing color
1. Samples of each type of glass 12 inches (304.8 mm) x 12 inches minimum)
2. In place sample of sealant at frame perimeter for Architect’s approval. Architect will select colors from manufacturer’s full available colors.
3. Samples of framing finish and fastener types for Architect’s approval. Architect will select finishes and colors from those available from manufacturer.

F. Certification of Installation:
   1. Provide written certification stating that materials providing meet the specified requirements.
   2. Include the following specific information indicating their compliance with referenced standards.
      a. Thermal movement.
      b. Structural properties.
      c. Water penetration.
      d. Air leakage.
      e. Finishes on aluminum surfaces.

G. Coordination:
   1. Copy Owner's hardware consultant on shop drawings for coordination.

1.06 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. In addition to complying with pertinent codes and regulations of governmental agencies having jurisdiction, comply with pertinent recommendations contained in the above referenced Flat Glass Marketing Association publications.

C. Furnish a valid AAMA "Notice of Product Certification" indicating that the windows for the project conform to AAMA/NWWDA 101/I.S.2-97.

1.07 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00, Project Management and Coordination.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle and protect windows and accessories in accordance with AAMA CW-10-97 until project completion.

1.09 WARRANTY

A. Warrant the work specified herein for (2) years, against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Faulty, improper or inadequate attachment or installation.
   2. Chipped edges, broken, or scratched glass.
   3. Defective finish of molding.
   4. Distortion or waves.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers listed whose product meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.
   1. Glass:
      a. AGC Flat Glass North America, Kingsport Tenn. (423) 229-7200
      b. Guardian Industries Corp., Corsicana TX; (800) 527-2511
      c. Oldcastle Glass Houston, Houston, TX; (866) 653-2278
      d. Pilkington, Toledo, OH; (419) 247-2721
      e. PPG Industries, Inc., Pittsburgh, PA; (412) 434-2858
      f. Viracon, Owatonna, MN; (800) 533-2080
   2. Aluminum Framing System, and Doors:

a. EFCO Corp., Monett, MO; (800) 221-4169
b. Kawneer Co., Inc., Jonesboro, GA; (770) 478-8841 (Basis of Specification)
c. Tajima Corp USA, Los Angeles, CA; (818) 547-4595
d. TRACO Windows, Cranberry Township, PA (888-887-5945)
e. Tubelite Storefronts & Entrances, Reed City, MI; (800) 866-2227
f. United States Aluminum, Waxhachie, TX; (800) 627-6440
g. Vistawall Architectural Products (Oldcastle Glass), Terrel, TX; (972) 551-6100
h. Wikk Industries, Inc., Greendale, WI; (414) 421-9490
i. YKK AP America, Inc., Grand Prairie, TX; (972) 206-2555

3. Aluminum Window Manufacturers:
   a. EFCA Corp., Monett, MO; (800) 221-4196
   b. Kawneer Co., Inc., Jonesboro, GA; (770) 478-8841
   c. TRACO Windows, Cranberry Township, PA; (888) 887-5945
   d. Vistawall Architectural Products (Oldcastle Glass), Terrel, TX; (972) 551-6100
   e. Any of the above manufacturers accepted for Aluminum Storefronts who produce aluminum windows as specified.

2.02 PERFORMANCE SPECIFICATIONS

A. Requirements apply simultaneously through the most adverse conditions of each exterior application.
   1. Windloads: Design system to withstand positive and negative windloads normal to the place of the wall in excess of 20 psf.
   2. Thermal Movement: Provide for noiseless expansion and contraction of all materials and assemblies due to temperature changes in a range between 10 degrees Fahrenheit (-12.22 degrees Celsius) and 180 degrees Fahrenheit (82.22 degrees Celsius) without detriment to appearance or performance.
   3. Water Infiltration: Drain water entering at joints and condensation occurring within the wall construction to the exterior face of the wall. Allow no uncontrolled water other than condensation on the interior face of the wall.
   4. Air Infiltration: Limit air leakage to maximum 0.06 cfm per square foot of wall projected area. (Storefront at 8 lb./sq.ft.)_

B. Aluminum Window Requirements Conformance to specifications in AAMA/NWWDA 101/I.S.2 when tests are performed on the prescribed 8’0” x 5’0” minimum test size with the following test results:
   1. Air Infiltration: Maximum .07 cfm/square foot when tested per ASTM E 283 at a static air pressure difference of 1.57 psf.
   2. Water Penetration: No uncontrolled ware leakage when tested per ASTM E547 and ASTM E331 at a static air pressure difference of 10 psf.
   3. Uniform Structural: Window to be operable, and maximum .4% permanent deformation per member when tested per ASTM E 330 at a static air pressure difference of 67.5 psf.

2.03 MATERIALS

A. Aluminum:
   1. Aluminum Alloys: Comply with the standards and designations of the Aluminum Association and the following ASTM Standards:
      a. Sheet and Plate: ASTM B209
      b. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221
      c. Bars, Rods, and Wire: ASTM B211
      d. Standard Structural Shapes: ASTM B308
      e. Drawn Seamless Tube: ASTM B210
      f. Extruded Structural Pipe and Tubes: ASTM B429
      g. Welding Rods and Bare Electrodes: AWS Code
   2. Aluminum Finish: Anodized.

a. Quality Standard: Conforming to AAMA 2604 for applied finishes or AAMA 661 for anodized finishes.
b. Pretreatment: Five-stage; zinc chromate conversion coating.
c. Application: Electrostatic spray and oven bake by approved applicator.
d. Coating Quantity: Minimum one primer coat and one-color coat.
e. Dry Film Thickness: Minimum 1.2 mils (0.03048 mm) on exposed surfaces, except inside corners and channels.

B. Steel:
1. Carbon Steel: Refer to the Structural Steel Section. Provide structural reinforcement as required.
2. Stainless Steel Fasteners: ASTM A167, type 302/304 No. 4 satin finish where exposed.
3. Metals used for shims shall be galvanized steel (ASTM A36 or ASTM A238) where noted as steel and stainless steel (300 series) where noted as stainless steel. Do not use aluminum or plastic shims unless approved by the Architect.
4. Exposed Cladding, Trim, and Panels: Provide cladding elements with formed edge flanges and backside stiffener members as required to maintain such flatness that when measured at room temperature the maximum slope of the surface at any point, measured from the nominal plane of the surface in its final installed position shall not exceed 1.25 degrees.
5. Metal Protection: Materials used as permanent or temporary protection for metals shall conform with the following standards:
a. Bituminous Paint: FS TT-C-494 or MIL-P-6883A.
b. Mastic Bulk Compound: FS SS-C-153, Type I or Type II.
c. Preformed Mastic Tape: NAAMM Specifications for Non-Shrinking Non-Resilient Preformed Sealing Compound.
d. Zinc Rich Paint: MIL-P-38 336.

C. Glazing Materials at Hollow Metal Frames:
1. General: Use glazing compounds and preformed glazing sealants approved for the application and, except as otherwise specified, conforming to Glazing Materials portion of FGMA Glazing Manual.
2. Sealant:
a. One (1) part acrylic polymer sealant conforming to FS TT-S-00230 or silicone, FS TT-S-0023-C. Use for glazing of all fixed glass. Include primer as recommended by manufacturer.
b. Color: To match frame.
c. All sealants shall be compatible with adjacent material per manufacturer’s instruction.
3. Setting Blocks: Hard rubber or clean grain softwood.
4. Back-up Material: Foamed polyethylene or polystyrene rodstock, sizes as required by joint condition, and compatible with sealant.
5. Glazing Tape: DAP #1202 or as approved.
6. Glazing Gaskets: Extruded neoprene, free of porosity, surface defects, dimensional irregularities and conforming to physical properties of ASTM C509.
7. Use of metal sash putty will not be permitted, but compound conforming to FS TG- 410 will be permitted. The use of non-skinning compounds, non-resilient type preformed sealers, and preformed impregnated type gasket will not be permitted.

D. Glazing Materials at Aluminum Framing:
1. Glazing Gaskets: Extruded neoprene (Color: Black) sized to fit the frame.
2. Sealant: Comply with Federal Spec. TT-S-00230

E. Concealed Reinforced Materials:
1. Steel:
a. Carbon Steel: Refer to the structural steel section. Provide structural reinforcement as required.

b. Metal Protection: Materials used as permanent or temporary protection for metals shall conform with the following standards:
   1) Bituminous Paint: FS TT-C-494 or MIL-P-6883A.
   2) Mastic Bulk Compound: FS SS-C-153, Type I or Type II.
   3) Preformed Mastic Tape: NAAMM Specifications for Non-Shrinking, Non-Resilient Preformed Sealing Compound.
   4) Zinc Rich Paint: MIL-P-38 336.

F. Glass:
1. General:
   a. Glass shall meet the requirements of ASTM C1036.
   b. Float Glass: Care shall be taken to minimize the tong marks and, unless indicated otherwise on the drawings, the tong marks shall occur at the bottom of the glass (after installation).
   c. All glass shall be heat strengthened unless noted otherwise.
   d. Color of tinted glass shall be as selected by Architect.
   e. Safety Glazing: Subject to compliance with requirements, obtain safety glazing products permanently marked on each individual glass lite with certification label of manufacturer acceptable to authorities having jurisdiction. Safety glazing shall conform to ANSI Z97.1, Safety Performance Specification, and ANSI Z97.1, Safety Glass Code, and IBC 2406.1 as applicable.
2. Glass Types: (As shown or required)
   a. Type GL1: 1/4 inch (6.35 mm) thick glazing quality, clear, tempered float glass.
   b. Type GL2: Tempered Fire Rated Glass (clear): Fire protected, glazing assembly safety rated and tested in accordance with NFPA 80; thickness as required to provide specified rating; STR – 28 STC; SHGC 0.82; Glazing shall be clear, colorless and free from unusual distortion; Fire Rating as indicated on drawings. ‘FireLite’ Plus or approved equal.
   c. Type GL3: 1” Insulating tempered glass unit comprised of an exterior sheet of 1/4 inch (6.35 mm) thick glass, an interior low-e tint layer of solarban 70 and an inner sheet of impact-resistant laminated glass constructed of two sheets of 1/8 inch (3.18 mm) thick glass separated by a 0.030 inch (0.76 mm) thick PVB interlayer. Comply with ASTM C1172 for kinds of laminated glass indicated and other requirements specified.
   d. Type GL4: 1” Fire Rated Insulated glass unit comprised of 5/16” FireLite Plus with a 9/16” air space and low-e tint layer of solarban 70 and a 1/4” tempered glass. STC Rating: 38. Comply with NFPA 80, 252, 257
      1) Interlayer: Interlayer material as indicated below, clear or in colors, and of thickness indicated with a proven record of no tendency to bubbly, discolor, or lose physical and mechanical properties after laminating glass lites and installation.
         (a) Interlayer Material: Polyvinyl butyral sheets.

G. Aluminum and Glass Entrance Doors: Kawneer Co., Inc., “Wide Stile” Standard Entrance or equivalent product from list of approved manufacturers.
1. Doors: Shall be 1-23/32 inch (44 mm) thick, consisting of 6 inch (152.4 mm) vertical stile, 6 inch mid rail, 6” top rail and 12 inch (304.8 mm) bottom rail aluminum tubular sections with 0.125 inch (3.18 mm) thick nominal wall thickness.
2. Connections:
   a. Provide bolted and welded connections, fit to a hairline joint.
   b. Provide reinforcing at bolted attachments. Tapped aluminum is not permitted.
   c. Provide concealed screws, nuts, bolts, and anchors, except hardware screws on butt of door, of non-corrosive metal.
3. Glass in Door: Refer to Door and Window Schedule. Deliver doors to job pre-glazed.

4. Glazing Gaskets: Use manufacturers recommended gaskets for flush glazing (Color: Black).
5. Mullion Stabilizer: Provide as required at double acting doors with removable mullion.
6. Hardware: Refer to Section 08 71 00, Finish Hardware.

H. Aluminum Storefront / Entrance Framing System: Kawneer Co., Inc., “TRIFAB VG 451 T (VersaGlaze)”, typically; or equivalent product from list of approved manufacturers:
1. Size 2 inch (50.8 mm) by 4-1/2-inch flush glazed type (typical).
2. Provide mullion reinforcement, of necessary, to achieve structural requirements.
3. Glass Pockets: Shall be sized to accept specified glass.
4. Provide sill receptors with end dams. (At all sill conditions.)

I. Aluminum Curtain Wall System: Kawneer Co., Inc., 1600 Wall System 1 Series or equivalent product from list of approved manufacturers:
1. Structural Properties:
   a. Limit the dead load deflection of horizontal members supporting glass to 1/175 of the clear span with a 1/8-inch maximum deflection.
   b. Limit the deflection of any member in a direction parallel to the plane of the wall and of any corner mullion in both parallel and perpendicular directions to a maximum of 25 percent of the glass bite dimension and maintain a minimum of 1/8 inch (3.18 mm) clearance between the member and the edge of the glass, panel, or other component.
   c. Limit the wind load deflection of any member to 1/240 plus 1/4 inch (6.35 mm) of the clear span, based on “pinned” ends.
   d. Limit the wind load deflection of corner mullions to the span as specified above, with the specified pressure acting on one face of the building with no pressure action on the other adjacent face, or 1/2 the specified pressure acting on one face of the building with 1/2 the specified suction acting on the adjacent face, whichever is greatest.
   e. No wall element shall sustain permanent deflection of glass breakage under maximum design load.
   f. The panels and their connections shall accommodate movements of the structure resulting from lateral forces. Provide connections with sufficient ductility to preclude brittle failure, at or near, welds.
   g. Framing Sizes: 2 inches (50.8 mm) x 6 inches (152.4 mm) where indicated on the drawings or increased sizes to accommodate loading.

PART 3 EXECUTION

3.01 PREPARATION

A. Obtain hardware templates from finish hardware supplier.

3.02 SURFACE CONDITIONS

A. Examine the areas and conditions under which Work of this Section will be preformed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Clean glazing channels, stops, and rabbets to receive the glazing materials, making free from obstructions and deleterious substances which might impair the work.
1. Remove protective coatings which fail in adhesion or interfere with bond of sealants.
2. Comply with manufacturers’ instructions for final wiping of surfaces immediately prior to application of primer and glazing compounds or tapes.
3. Prime surfaces to receive glazing compounds in accordance with manufacturer’s recommendations.

3.03 INSTALLATION

A. Inspect each piece of glass immediately prior to start of installation.

1. Do not install items which are improperly sized, have damaged edges, or are scratched, abraded, or damaged in any other manner.
2. Do not remove labels from glass until so directed by the Architect.
3. Install glass so distortion waves, if present, run in the horizontal direction.

B. Locate setting blocks at sills one quarter of the width of the glass in from each end of the glass, unless otherwise recommended by the glass manufacturer.
1. Use blocks of proper size to support the glass in accordance with the manufacturer's recommendations.
2. Provide spacers for all glass sizer larger than 50 united inches, to separate glass from stops; except where continuous glazing gaskets or felts are provided.
a. Locate spacers no more than 24 inches (609.6 mm) apart, and no closer than 12 inches (304.8 mm) to a corner.
b. Place spacers opposite on another.
c. Make bite of spacer on glass 1/4 inch (6.35 mm) or more.

C. Set glass in a manner which produces the greatest possible degree of uniformity in appearance.

D. Do not use two (2) different glazing materials in the same joint system unless the joint use is approved in advance by the Architect.

E. Mask, or otherwise protect, surfaces adjacent to installation or sealants.

F. Install all glass, gasket, and aluminum framing in accordance with manufacturer's printed instructions. Installed windows units shall conform to AAMA 502 minimum requirements for air and water infiltration.

G. Caulk joints where indicated to meet performance specifications using materials specified in Sealants section. Follow sealant manufacturer's printed instructions for the installation of his product.

H. Erection Tolerances:
1. Maximum Deviation from Vertical: 1/8 inch (3.18 mm) in any story and 1/4 inch (6.35 mm) in any 45 foot (1371.6 cm) run.
2. Maximum Deviation from Horizontal: 1/8 inch (3.18 mm) in any 30 foot (914.4 cm) run.
3. Maximum Deviation from True Alignment: 1/32 inch (0.79 mm) for any two (2) abutting units. Allow no edge projections.
4. Maximum Joint Gap: 1/32 inch (0.79 mm).
5. Maximum Openings Between Movable Glazing Stop and Adjacent Member: 1/32 inch (0.79 mm).

3.04 PROTECTION AND ADJUSTMENTS

A. Protect glass from breakage after installation by promptly installing streamers or ribbons suitably attached to the framing and held free from glass. Do not apply warning markings, streamers, ribbons, or other items directly to the glass except as specifically directed by the Architect.

B. Adjust windows as necessary for smooth and weather tight operation and leave windows clean and free of construction debris.

END OF SECTION 08 80 00

SECTION 08 91 00
METAL LOUVERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

1.02 SUMMARY

A. Section Includes: Fixed wall louvers and accessories.

1.03 PERFORMANCE REQUIREMENTS

A. Structural Requirements: Design louvers to safely withstand dead load and live loads prescribed by governing building code.

B. Thermal Movement: Design to accommodate expansion and contraction resulting from normal air temperature range of zero to 120 degrees Fahrenheit (48.89 degrees Celsius), solar heat gain, and nighttime re-radiation without buckling, undue stress on structural elements, reduction of performance, or other detrimental effects.

1.04 SUBMITTALS

A. Product Data.

B. Shop Drawings: Show elevations, field measurements (if applicable), reinforcement, anchorages, and expansion provisions.

C. Samples for Selection of Coated Finishes: Coating manufacturer’s color selection data.

D. Samples for Verification of Coated Finishes: For each type and color of coated finish, submit 12-inch-long section of extrusions or formed sections and 6-inch-square sheets.

1.05 PROJECT CONDITIONS

A. Field Measurements: Where conditions permit, take field measurements and determine actual installed positions of louvers before beginning louver fabrication.

1.06 WARRANTY

A. Warranty: Submit written warranty signed by the manufacturer guaranteeing flouroploymer finish for 20 years after substantial completion, without reducing or otherwise limiting any other rights to correction which the Owner may have under the Contract Documents. Failure includes cracking, peeling, blistering, chalking, and fading in excess of 3 NBS points.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall Louvers: Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
   1. Airline Products Company.
   2. Airolite Company.
   3. All-Lite Metal Company.
   4. Construction Specialties, Inc.
   5. Reliable Products/Hart & Cooley, Inc.
   6. Ruskin.

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B221, manufacturer’s standard alloy and temper for application and finish required.

B. Fasteners:
   1. For Aluminum Members: Aluminum, stainless steel, or galvanized steel.
   2. For Steel or Galvanized Steel Members: Stainless steel or galvanized steel.

3. For Stainless Steel Members: Stainless steel.
4. Finish exposed-to-view fastener heads to match adjacent surface.

C. Anchors and Inserts: Hot-dip galvanized steel or nonferrous metal.

D. Bituminous Paint: SSPC-Paint 12; cold-applied asphalt mastic.

2.03 FIXED WALL LOUVERS

A. Louvers: Drainable blade, standard mullion type.
1. Depth: 4-inches.
2. Fabricate blades and frame from extruded aluminum; minimum thickness: 0.125 inch (3.18 mm).
3. Performance requirements:
a. Minimum free area: 45 percent.
b. Design air velocity: 500 feet (15240 cm) per minute.
c. Maximum static pressure drop at design velocity: 0.18 inch (4.57 mm) water.
1) Velocity at which water penetration begins: Greater than design velocity.
4. Finish: Kynar 500.
5. Accessories: Insect screens, subsill flashing.

2.04 WALL LOUVER ACCESSORIES

A. Screens: Removable type; provide screens for indicated exterior louvers.
1. Frame: Fabricate from same material used for louver. Miter and reinforce frame corners.
a. Fabricate frame from extruded of formed metal. Provide insert or driven spline for mesh attachment. Frame must be capable of being rewired.
2. Insect screen mech: 18 by 16 mesh, 0.011 inch (0.28 mm) aluminum wire.
3. Position screen on inner louver face; attach using machine screws located 3 inches (76.2 mm) from corner and 12 inches (304.8 mm) on center between corners.

2.05 FABRICATION

A. Provide complete, shop-fabricated units, unless unit size dictates shipment in pieces; mark each component as required for proper field assembly.

B. Minimize the necessity for field assembly and field modifications. Coordinate shop drawings, field measurements, and shop fabrication.

C. Fabricate frames to indicate profiles with features and clearances to suit installation conditions.
1. Include integral sills of finish and construction to match louver. At locations indicated or where required to prevent drainage infiltration, provide sill extensions or subsill flashings of same finish and material as louver.
2. Provide clearance or recesses as required to accommodate sealant between louver and adjacent construction.

D. Provide shop-welded joints between framing components, and between framing components and fixed louver blades, unless otherwise indicated or where field assembly is unavoidable.

E. Provide uniform spacing between blades, including gap between blades and exposed face of head and sill members.

F. Provide vertical mullions of type indicated.

2.06 FINISHES

A. Finish: High-Performance Organic Coating.
1. Fluoropolymer Two-Coat Coating System: Manufacturer’s standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates and openings to receive louvers are rigidly set, at proper lines and elevation, properly sized, and ready to receive louvers.

B. Do not proceed with installation until conditions detrimental to proper installation have been corrected.

3.02 PREPARATION

A. Coat contact surfaces of dissimilar metals with one or more coats of bituminous paint. The following metal are not considered dissimilar: Aluminum, stainless steel, and zinc.

B. Apply one 15-mil dry film thickness coat of bituminous isolation coating to metal surfaces, other than galvanized steel, which will be in contact with cementitious materials.

3.03 INSTALLATION

A. Install louvers in accordance with manufacturer's instructions and shop drawings.

B. Coordinate louver installation with adjacent elements of building envelope to ensure watertight construction.

C. Set units and flashings in proper location, plumb and true, free of warp or twist.

D. Fit joints tightly; where joint sealers are to be installed, make joints of sizes required.

3.04 CLEANING

A. Remove protective material form prefinished surfaces immediately after installation.

B. Wash exposed surfaces using mild detergent; thoroughly clean inside corners.

C. Remove excess sealant by moderate use of mineral spirits or other solvent recommended by sealant manufacturer.

D. Touch up marred or abraded areas of finished elements. If satisfactory touch-up cannot by accomplished, remove and replace elements.

END OF SECTION 08 91 00

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES - USG

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Gypsum wallboard.

1.02 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2024.

C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.

D. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

E. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. In accordance with Contract Conditions and Division 1, submit for review product data and manufacturer's load and deflection criteria annotated to show each stud gage and spacing proposed for required application.

1.04 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Tolerances:
   1. For exposed work, maximum 1/16" difference in true plane at joints between adjacent boards before finishing. After finishing, joints shall be invisible. No gaps or voids between gypsum board units or between drywall and adjacent work, unless detailed otherwise. Maximum 1/8" in 10' deviation from true plane, plumb and level in finished work.
   2. For concealed work (area separation partitions in attic), maximum difference in true plane at joints, 3/32"; bed and tape joints only.

C. Where fire ratings and U.L. design numbers are included, provide only systems which are identical to those tested in accordance with ASTM E119 and to referenced designations in UL Fire Resistance Directory.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. USG Corporation: www.usg.com/#sle.

B. Gypsum board: ASTM C 36, 5/8" type "X"; U.S. Gypsum, Gold Bond, Domtar or equal acceptable to Architect. Provide water-resistant type ("green board" for walls and ceilings in wet and damp areas (e.g. Clinic Shower). Provide other special types or thickness where indicated or required.

C. Drywall framing: Screw-up steel studs, ASTM C645 ; use 20 or 25 gage as indicated on Drawings, or if not indicated, as recommended by manufacturer for height required, for maximum L/240 deflection; provide 7/8" metal furring channels where shown.

D. Use diagonal metal stud bracing to structure where required for stiffness.

E. Ceiling suspension and furring materials: Steel runners and galvanized hanger wire.

F. Joint reinforcement: ASTM C475/C475M paper tape and ready-mixed or job-mixed vinyl joint compound. Provide two-compound treatment, one compound for bedding, and a compatible compound for finishing.

G. Accessories: Galvanized steel runner track, slotted head track, J-beads, corner beads, casing beads, control joints, insulation stick-clips and other materials as required for a complete installation.

H. Sealant: U.S. Gypsum Acoustical Sealant or equal acceptable to Architect. Where required to meet fire resistance ratings, provide non-shrinking, non-migrating polyisobutylene/polybutene sealant.

I. Drywall system requirements:
   1. Lateral loading: 5 psf.
   2. Deflection limit: 1/240 of partition height.
   3. Sound transmission class: 35 STC Minimum.

J. Acoustical Insulation: Mineral fiber batts; thickness as indicated. Refer to Specification Section 07 21 00 - Thermal Insulation for additional information.

K. Blocking: Fire-retardant treated wood blocking in nominal 2” thickness.

2.03 GYPSUM WALLBOARD ACCESSORIES

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with system manufacturer’s instructions for product delivery, storage and handling and environmental conditions, and with installation instructions and recommendations. Protect steel stud materials and metal accessories from rusting.

B. Provide additional framing and blocking to support fixtures, equipment, accessories and all other work which is connected to gypsum drywall systems.

C. Comply with ASTM C840 and GA-216

D. Install framing system studs at spacing(s) indicated on drawings. Provide additional studs at corners, tees, openings and control joints and elsewhere where required.

E. Use full length studs between runner tracks.

F. Friction fit studs to runner tracks by positioning and rotating into place. Provide positive attachment to runner tracks for studs located at partition corners and intersections, and studs adjacent to openings using 3/8” self-tapping screws or stud clinching tool on both flanges of studs.

G. Provide trim accessories of the sizes required for the applications shown and specified, fabricated from galvanized steel, and of the following types:
   1. Provide metal corner bead at external corners with smooth rigid nose and perforated and knurled flanges.

H. Provide fire-rated systems where indicated and where required by authorities having jurisdiction. Unless otherwise required to meet code or UL requirements, fill expansion joints and gaps at perimeter and penetrations with compressible fire-retardant filler, and seal with fire-retardant sealant.

I. Provide acoustical insulation where indicated on drawings in accordance with manufacturer's instructions.

J. Install boards perpendicular to framing members. Do not allow butt-to-butt joints and joints that do not fall over framing members.

K. Install trim and joint treatment in strict compliance with manufacturer's instructions and recommendations. Install trim in continuous lengths up to maximum lengths available to minimize intermediate joints between ends or corners. Sand and leave ready for finish painting.

L. Provide Fry Reglet F-molding where indicated on drawings.

M. All rated assemblies shall be labeled in accordance with Section 09 91 00 - Painting.

N. All rated assemblies shall be labeled in accordance with Section 07 84 13 - Firestopping .

END OF SECTION 09 21 16

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2024.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.

F. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

G. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

H. ASTM E413 - Classification for Rating Sound Insulation; 2022.

1.02 SUMMARY

A. Section Includes:

B. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   1. Suspension systems for interior gypsum ceilings and soffits.

C. This Section includes non-load-bearing steel framing members for the following applications:
   1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
   2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.03 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

PART 2 PRODUCTS

2.01 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Framing Members, General: Comply with ASTM C754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C645 requirements for metal, unless otherwise indicated.
   2. Protective Coating: ASTM A653/A653M, G60 (Z180), hot-dip galvanized, unless otherwise indicated.

2.02 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
   a. Type: Postinstalled expansion anchor.
2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Flat Hangers: Steel sheet 1 by 3/16 inch (4.76 mm) by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum ½-inch- wide flanges.
   1. Depth: 1-1/2 inches (38 mm).

F. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum ½-inch- wide flanges, ¾ inch deep.
   2. Steel Studs: ASTM C645.
      a. Minimum Base-Metal Thickness: As indicated on Drawings.
      b. Depth: As indicated on Drawings.
   3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch (22.22 mm) deep.
      a. Minimum Base Metal Thickness: As indicated on Drawings.

G. Grid Suspension System for Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Products: Subject to compliance with requirements, provide one of the following or an approved equal:
      a. Armstrong World Industries, Inc.; Drywall Grid Systems.
      b. Chicago Metallic Corporation; 640-C Drywall Furring System.
      c. USG Corporation; Drywall Suspension System.

2.03 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C645.
   1. Minimum Base-Metal Thickness: As indicated on Drawings.
   2. Depth: As indicated on Drawings.

B. Slip-Type Head Joint: Where indicated, provide one of the following:
   1. Single Long-Leg Runner System: ASTM C645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (304.8 mm) of the top of studs to provide lateral bracing.
   2. Double-Runner System: ASTM C645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
   3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Products: Subject to compliance with requirements, provide one of the following or an approved equal.
         1) Steel Network Inc. (The); VertiClip SLD Series.
         2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly

indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following or an approved equal:
   a. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
   b. Metal-Lite, Inc.; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Minimum Base-Metal Thickness: As indicated on Drawings.

E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum ½-inch- wide flanges.

F. Depth: As indicated on Drawings.
   1. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 mm), 0.068-inch- thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
   1. Minimum Base Metal Thickness: AS indicated on Drawings.
   2. Depth: As indicated on Drawings.

H. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum ½-inch- wide flanges.
   1. Depth: As indicated on Drawings.
   2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum base-steel thickness of 0.0312 inch (0.79 mm).
   3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22.22 mm), minimum bare-metal thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.04 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:
   1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
   2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.18 mm) thick, in width to suit steel stud size.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free and contract with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner hat will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to steel roof deck.
   6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch (3.18 mm) in 12 feet (365.76 cm) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.05 INSTALLATION FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.
   1. Space studs as follows:
      a. Single-Layer Application: 16 inches (406.4 mm) o.c. unless otherwise indicated.
      b. Tile backing panels: 16 inches (406.4 mm) o.c. unless otherwise indicated.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing system that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb, unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum ½- inch clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
      a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
   5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Direct Furring:

E. Attach to concrete with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (609.6 mm) o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3.18 mm) from the plane formed by faces of adjacent framing.

END OF SECTION 09 22 16

SECTION 09 29 00
GYPSUM BOARD

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

B. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

C. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.

D. 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; 2022.

E. 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; 2022.

F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

G. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

I. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2024.

J. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

K. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

L. ASTM E413 - Classification for Rating Sound Insulation; 2022.

1.02 SUMMARY

A. Section Includes:
   1. Interior gypsum board.
   2. Tile backing panels.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each texture finish indicated on same backing indicating for Work.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.02 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Georgia-Pacific Gypsum LLC.
   2. National Gypsum Company.

3. USG Corporation.

B. Gypsum Board, Type X: ASTM C1396/C1396M.
   1. Thickness: 5/8 inch (15.88 mm).
   2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C1396/C1396M.
   1. Thickness: ½ inch.
   2. Long Edges: Tapered.

D. Abuse-Resistance Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C 1629/C 1329M.
   1. Core: 5/8 inch (15.88 mm), Type X.
   2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
   3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
   4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
   5. Long Edges: Tapered.
   6. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D 3274.

2.04 TILE BACKING PANELS

A. Glass-Mat, Water-Resistance Backing Board: ASTM C1178/C1178M, with manufacturer's standard edges.
   1. Core: 5/8 inch (15.88 mm), Type X.
   2. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D 3274.

2.05 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced.
   2. Shapes:
      a. Cornerbead.
      b. L-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.
      d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      e. Expansion (control) joint.

2.06 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, beveled panel edges, and damaged surfaces areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.
   5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.07 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
   1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (2.84 mm) thick.

C. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining, latex sealant complying with ASTM C834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.
   1. Products: Subject to compliance with requirements, available products that may by incorporated into the Work include, but are not limited to, the following:
      a. Accumetric, LLC; BOSS 824 Acoustical Sound Sealant.
      b. Specified Technologies, Inc.: Smoke N Sound Acoustical Sealant.
      c. USG Corporation: SHEETROCK Acoustical Sealant.

PART 3 EXECUTION

3.01 APPLYING AND FINISHING PANELS

A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

B. Comply with ASTM C840.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide ¼- to ½-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

E. Prefill open joints, beveled edges, and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile.
   3. Level 3: Where indicated on Drawings.
   4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
   5. Level 5: Where indicated on Drawings.

3.02 PROTECTION

A. Protect installed products from damaged from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 09 29 00 09 29 00

SECTION 09 50 00
ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

B. ASTM A580/A580M - Standard Specification for Stainless Steel Wire; 2023.

C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

G. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2026.

J. ASTM E795 - Standard Practices for Mounting Test Specimens during Sound Absorption Tests; 2023.

K. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

L. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2024.

M. ASTM F594 - Standard Specification for Stainless Steel Nuts; 2024.

1.02 SUMMARY

A. Section Includes:
   1. Acoustical ceiling panels.
   2. Exposed grid suspension system.
   3. Wire hangers, fasteners, main runners, cross tees, and wall angle molding.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer’s technical data for each type of acoustical ceiling unit and suspension system required.

B. Samples: Minimum 6 inch (152.4 mm) x 6 inch samples of specified acoustical panel; 8 inch (203.2 mm) long samples of exposed wall molding and suspension system, including main runner and 4 foot (121.92 cm) cross tees.

C. Shop Drawings: Layout and details of acoustical ceilings show locations of items, which are to be coordinated with or, supported by the ceilings.

D. Certifications: Manufacturer’s certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings or applicable testing and inspecting organization.

1. Surface Burning Characteristics: A follows, tested per ASTM E84.
   a. Flame Spread: 25 or less.
   b. Smoke Developed: 50 or less.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.06 PROJECT CONDITIONS

A. Space Enclosure:
   1. All ceiling products and suspension systems must be installed and maintained in accordance with manufacturer's written installation instructions for that product in effect at the time of installation and best industry practice. Prior to installation, the ceiling product must be kept clean and dry, in an environment that is between 32□F and 120□F and not subject to Abnormal Conditions. Abnormal conditions include exposure to chemical fumes, vibrations, moisture from conditions such as building leaks or condensation, excessive humidity, or excessive dirt or dust buildup.
   2. HumiGuard Plus Ceilings: Installation of the products shall be carried out where the temperature is between 32□F (0□C) and 120□F (49□C). It is not necessary for the area to be enclosed or for HVAC systems to be functioning. All wet work (plastering, concrete, etc.) must be complete and dry. The ceilings must be maintained to avoid excessive dirt or dust buildup that would provide a medium for microbial growth on ceiling panels. Microbial protection does not extend beyond the treated surface as received from the factory, and does not protect other materials that contact the treated surface such as supported insulation materials.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Seismic Loads: Design and size components to withstand seismic loads in accordance with the International Building Code, Section 1621.2.5 for Category B.

C. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.02 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
   2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance's unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E795.

E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.03 ACOUSTICAL PANELS

A. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for acoustical tiles 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. Lay-in Panels (Re: Room Finish Schedule for Locations):
      a. Lay-in Acoustical Panels (Ultima 1942HRC):
         1) Material: Wet-formed mineral fiber.
         2) Size: 24-inches x 24-inches x ¾-inch thick.
         3) Edge Detail: Beveled Tegular.
         4) NRC: 0.75 minimum in accordance with ASTM E1264.
         5) CAC: 35 minimum in accordance with ASTM E1264.
         6) Surface Finish: Factory applied white vinyl latex paint, white unless noted otherwise.
         7) Fire Resistance: Class A.
         8) Pattern: Smooth texture.
         9) Approved Product / Manufacturer: "Ultima Lay-In" conforming to No. 1942HRC as manufactured by Armstrong World Industries, Inc., or Architect approved equal by approved manufacturers.
   2. Lay-in Panels (Antimicrobial):
      a. Lay-in Panels (Re: Room Finish Schedule for Locations):
         1) Material: Wet-felted.
         2) Size: 24-inches x 24-inches x 9/16-inch.
         3) Edge Detail: Square Tegular.
         4) NRC: 0.95 minimum in accordance with ASTM E1264.
         5) CAC: 29 minimum in accordance with ASTM E1264.
         6) Surface Finish: Scrubbable factory applied white vinyl plastic paint.
         7) Fire Resistance: Class A.
         8) Pattern: Smooth.
         9) Approved Product / Manufacturer: "Optima" conforming to No. 3216PB as manufactured by Armstrong World Industries, Inc., or Architect approved equal by approved manufacturers.

2.04 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C635/C635M.
   1. High-Humidity Finish: comply with ASTM C635/C635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.

B. Attachment Devices: Size for five time the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung", unless otherwise indicated. Comply with seismic design requirements.
   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load

equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B633, Class Fe/Zn 5 0 inch (0 mm) for Class SC 1 service condition.
b. Corrosion Protection: Stainless-steel components complying with ASTM F593 and ASTM F594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
c. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.

2. Power-Actuated Fasteners in Concrete: Fasteners system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
4. Size: Select wire diameter so its stress at three times hanger design load (((ASTM C635/C635M)), Table 1, “Direct Hung”) will be less than yield stress of wire, but provide not less than 0.135-inch- (3.5-mm-) diameter wire.

D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Angle Hangers: Angles with legs not less than 7/8 inch (22.22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

F. Seismic Stabilizer Bars: Manufacturer’s standard perimeter stabilizers designed to accommodate seismic forces.

G. Seismic Struts: Manufacturer’s standard compression struts designed to accommodate seismic forces.

H. Seismic Clips: Manufacturer’s standard seismic clips designed and spaced to secure acoustical panels in place.

I. Hold-Down Clips: Where indicated, provide manufacturer’s standard hold-down clips spaced 24 inches (609.6 mm) o.c. on all cross tees.

J. Impact Clips: Where indicated, provide manufacturer’s standard impact-clip system designed to absorb impact forces against acoustical panels.

2.05 METAL SUSPENSION SYSTEM

A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A653/A653M, not less than G30 (Z90) coating designation; with prefinished 15/16-inch- (24-mm) wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Steel or aluminum cold-rolled sheet.
5. Cap Finish: Painted white.

B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A653/A653M, not less than G30 (Z90) coating designation; with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
2. End Condition of Cross Runners: Butt-edge type.
3. Face Design: Flat, flush.
4. Cap Material: Steel or aluminum cold-rolled sheet.
5. Cap Finish: Painted white.

2.06 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Molding and Trim: Type and profile indicated or, of not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
   1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
   2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
   3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:
   1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B221 (((ASTM B221M))) for Alloy and Temper 6063-T5.
   2. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0 inch (0.01 mm) or thicker.
   3. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils 0 inch (0.04 mm). Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer's printed recommendations.

3.02 PREPARATION

A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.
   1. Furnish concrete inserts and similar devices to other trades for installation well in advance of time needed for coordination of other work.

3.03 INSTALLATION

A. Install SoundScapes Blades per manufacturer's installation instructions.

B. Install suspension system per ASTM C636 unless otherwise noted in the manufacturer's Installation instructions.

3.04 ADJUSTING AND CLEANING

A. Replace damaged and broken blades.

B. Clean exposed surfaces of blades, including trim, and suspension members comply with manufacturer's instructions for cleaning and touch up of minor finish damage.

C. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 50 00

SECTION 09 56 13
PANEL TEXTURED CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Gypsum Ceiling Panels
B. Hi-Strength Gypsum Ceiling Panels
C. Cleanroom Gypsum Ceiling Panels

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.
B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 PERFORMANCE CRITERIA

A. Ceiling Assembly Fire-Resistance Rating: 1-1/2-Hour per UL Assembly G259.

PART 2 PRODUCTS

2.01 MANUFACTURER / PRODUCTS

A. Basis of Design: Products of National Gypsum Company.

2.02 GYPSUM CEILING PANELS

A. Basis of Design: Gold Bond® BRAND Gridstone® Fire-Shield® Gypsum Ceiling Panels.
   1. Type X, Panel Physical Characteristics
      a. Core: Fire and sag resistant gypsum core.
      b. Size (nominal): 2 feet (60.96 cm) x 2 feet.
      c. Overall Thickness: ½ inch.
      d. Surface: 2 mil (0.0508 mm). white, stipple-textured vinyl laminate.
      e. Sound Attenuation: Class (CAC)-46 dB when tested in accordance with ASTM E1414 Standard Test Method for Airborne sound Attenuation between Rooms Sharing a Common Ceiling Plenum.
      f. Panel complies with requirements for Type X, Class 1 of ASTM C 1396 Standard Specification for Gypsum Board.
      g. Panel complies with requirements for Type XX, Patterns E, G of ASTM E1264 Standard Classification for Acoustical Ceiling Products.
      h. Light Reflectance: LR 1 (75% or greater).
      i. Surface Burning Characteristics when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials:
         1) Flame Spread: 5
         2) Smoke Development: 0

2.03 HI-STRENGTH GYPSUM CEILING PANELS

A. Basis of Design: Gold Bond® BRAND Gridstone® Hi-Strength Gypsum Ceiling Panels.
   1. Panel Physical Characteristics
      a. Core: Regular, high strength, sag resistant gypsum core.
      b. Size (nominal): 2 feet (60.96 cm) x 2 feet.
      c. Overall Thickness: 5/16 inch (7.94 mm).
      d. Surface: 2 mil (0.0508 mm)., white, stipple-textured vinyl laminate.
      e. Sound Attenuation: Class (CAC)-41 dB when tested in accordance with ASTM E1414 Standard Test Method for Airborne Sound Attenuation between Rooms Sharing a Common Ceiling Plenum.
      f. Panel complies with requirements for Class 1 of ASTM C 1396 Standard Specification for Gypsum Board.

g. Panel complies with requirements for Patterns E, G of ASTM E1264 Standard Classification for Acoustical Ceiling Products.
h. Light Reflectance: LR 1 (75% or greater).
i. Surface Burning Characteristics when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials:
1) Flame Spread: 5
2) Smoke Development: 0

2.04 CLEANROOM CEILING PANELS

A. Basis of Design: Gold Bond® BRAND Gridstone® CleanRoom® Gypsum Ceiling Panels.
1. Type X, Panel Physical Characteristics
a. Core: Fire and sag resistant gypsum core.
b. Size (nominal): 2 feet (60.96 cm) x 2 feet.
c. Overall Thickness: ½ inch.
d. Surface: 2 mil (0.0508 mm)., white, stipple-textured vinyl laminate sealed on the face and back. The edges are factory sealed with a coating that encapsulated the exposed edges, providing a completely sealed panel.
e. Sound Attenuation: Class (CAC)-46 dB when tested in accordance with ASTM E1414 Standard Test Method for Airborne Sound Attenuation between Rooms Sharing a Common Ceiling Plenum.
f. Panel complies with requirements for Type X, Class 1 of ASTM C 1396 Standard Specification for Gypsum Board.
g. Panel complies with requirements for Type XX, Patterns E, G of ASTM E1264 Standard Classification for Acoustical Ceiling Products.
h. Light Reflectance: LR 1 (75% or greater).
i. Surface Burning Characteristics when tested in accordance with ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials:
1) Flame Spread: 5
2) Smoke Development: 0

2.05 SUSPENSION GRIDS

A. Gypsum Ceiling Panels
1. Description: 15/16 inch (23.81 mm) exposed grid systems with tee grids.
2. Finish: White powder coat.

B. Cleanroom Gypsum Ceiling Panels:
1. Products: Gordon-DS-20 Gasket Seal System.
2. Description: Gasketed grid system with hold-down clips.
3. Finish: White powder coat.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer recommendations.

B. Gypsum Ceiling Panels.
1. Panels drop in place in standard exposed grid systems.

C. Cleanroom Gypsum Ceiling Panels.
1. Panels should be clipped down into a gasketed grid system.
2. If cuts are required, exposed core should be sealed to maintain the performance of the system.

3.02 CLEANING

A. Removed dirt and dust with mild soap and water.

END OF SECTION 09 56 1 09 56 13

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient base.

1.02 REFERENCE STANDARDS

A. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. In accordance with Contract Conditions and Division 1, submit for review samples, product data, and extra stock.

1.04 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Luxury Vinyl Tile: Complies with requirements for ASTM F1700 Standard Specification for Solid Vinyl Floor Tile, Class 1, Type A.
   1. As indicated of finish schedule.

B. Rubber Floor Tile: Interlocking rubber flooring tiles.
   1. Flexco 36" x 36" "Sprots Flooring", as standard of design.

C. 4" Rubber Cove Base: Roppe, as standard of design.
   1. Provide base in rolls, not short straight section.

D. Resilient Rubber Stair Tread without Riser.
   1. Roppe #98 Vantage w/raised circular pattern and nosing.

E. Color and pattern: As selected from manufacturer's full line of colors and textures.

F. Adhesive: Waterproof, approved by manufacturer of product applied.

G. Architect may select from any one of the following alternate manufacturers for proper color coordination.
   1. Tandus Centiva
   2. Armstrong
   3. Flexco
   4. Azrock
   5. Dinoflex

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare surfaces by cleaning, leveling and primping. Level to 1/8" in 10' tolerance.

3.02 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Comply with manufacturer’s instructions and recommendations regarding moisture content of surface schedule to receive flooring.

D. Install with tight, well-aligned joints. Install tile in ashlar pattern; lay out to prevent less than ½-tile units.

E. Deliver to Owner for extra stock all unused extra tile and base including at least 1 unopened box of tile and base.

3.03 CLEANING

A. Clean, polish, and protect from damage. Replace damaged materials.

B. Remove excess adhesive from floor, base, and wall surfaces without damage.

C. Clean in accordance with manufacturer's written instructions.

END OF SECTION 09 65 00

SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2025a.

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

C. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2025).

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.02 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient molding accessories.
   3. Rubber stair accessories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (304.8 mm) long.

PART 2 PRODUCTS

2.01 THERMOSET – RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
   2. Flexco.
   3. Roppe Corporation, USA.

B. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
   1. Style and Location:
      a. Style A, Straight: Provide in areas with carpet.
      b. Style B, Cove: Provide in areas with resilient flooring.

C. Thickness: 0.125 inch (3.18 mm).

D. Height: 4 inches (101.6 mm).

E. Lengths: Cut lengths 48 inches (1219.2 mm) long or Coils in manufacturer’s standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: As selected by Architect from full range of industry colors.

2.02 RUBBER STAIR ACCESSORIES

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq.cm.

B. Stair Treads: ASTM F2169.
   1. Type: TP (rubber, thermoplastic).
   2. Class: Ribbed.
   3. Group: 1 (embedded abrasive strips).

4. Nosing Style: Square]Round.
5. Nosing Height: 1-1/2 inches (38 mm).
6. Thickness: ¼ inch and tapered to back edge.
7. Size: Lengths and depths to fit each stair tread in one piece.
8. Integral Risers: Smooth, flat; in height that fully covers substrate.

C. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer as treads, and recommended by manufacturer for installation with treads.
1. Style: Coved toe, 7 inches (177.8 mm) high by length matching treads.
2. Thickness: 0.125 inch (3.18 mm).

D. Stringers: Height and length after cutting to fit risers and treads and to cover stair stingers, produced by same manufacturer as treads, and recommended by manufacturer for installation with treads.
1. Thickness: Manufacturer's standard.

E. Landing Tile: Produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

F. Locations: Provide rubber stair accessories in areas indicated.

G. Colors and Patterns: As selected by Architect from Manufacturer's full range.
1. Basis-of-Design Product: Subject to be compliance with requirements Resilient Rubber Stair Tread without Riser.
a. Roppe #98 Vantage with raised circular pattern and nosing.

2.03 RESILIENT ACCESSORY

A. Manufacturers: Provide products from one of the following manufacturers:
1. Armstrong World Industries, Inc.
2. Johnsonite.
3. Roppe Corporation.

B. Edge Reducer (Transition) Strips: Vinyl types of width required thickness to protect exposed edge of resilient flooring. Color as selected by Architect from manufacturer's standard color. Provide units of maximum available length, to minimize number of joints.

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for application indicated.

B. Adhesives: Water-resilient type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

3.02 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installation resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76.2 mm) in length.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76.2 mm) in length.

3.03 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection resilient products.

B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19
RESILIENT TILE FLOORING

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2025a.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.02 SUMMARY

A. Section Includes:
   1. Floor tile.
   2. Vinyl composition floor tile.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

C. Samples: Full-size units of each color and pattern of floor tile required.

1.04 CLOSEOUT SUBMITTALS

A. Maintain data.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq.cm.

2.02 FLOOR TILE

A. Colors, Textures, and Patterns: Where manufacturer’s standard products are indicated for products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements.
   1. As referenced on the drawings.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Tandus Centiva

2.03 LUXURY VINYL TILE

A. Luxury Vinyl Tile: Complies with requirements for ASTM F1700 Standard Specification for Solid Vinyl Floor Tile, Class III, Type B.
   1. As referenced on the drawings.

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for application indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
      a. Perform anhydrous calcium chloride test according to ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
      b. Perform relative humidity test using in situ probes according to ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.02 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles square with room axis in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain referenced markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.03 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 91 00
PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

B. Paint exposed surfaces, expect where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Submittals: For each paint system specified, provide the following:
   1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
   2. Manufacturer's Information: Providing manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

E. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated. After color selection, the Architect will furnish color chips for surfaces to be coated.

F. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
   1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors then preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
   2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.

G. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

H. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.
   1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface as specified.
   2. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.

I. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

J. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 degrees Fahrenheit (7.22 degrees Celsius). Maintain containers in

clean condition, free of foreign materials and residue. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste surfaces.

K. Project Conditions: Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 degrees Fahrenheit (-15 degrees Celsius) above the dew point; or to damp or wet surfaces.

L. Extra Materials: Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
   1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

PART 2 PRODUCTS

2.01 MATERIAL

A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.

C. Colors: Provide custom colors of the finished paint systems to match the Architect's samples.
   1. Verify sheen of all products with Architect.

PART 3 EXECUTION

3.01 INSTALLATION

A. Examine substrates, areas, and conditions under which painting will be performed for compliance with paint application requirements. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates.

C. Preparation: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

D. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

E. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
   1. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
      a. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.

2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
    c. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
    a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

F. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
2. Use only thinners approved by paint manufacturer and only within recommended limits.

G. Application: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.
4. The term "exposed surfaces" includes areas visible when permanent or built-in items are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint back sides of access panels and removeable or hinged covers to match exposed surfaces.
7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
8. Sand lightly between each succeeding enamel or vanish coat.
9. Label fire rated partitions as required by Authority Having Jurisdiction but at a minimum 15 feet (457.2 cm) from end of wall section and spaced 30 feet (914.4 cm) in Red Paint (SW 6871 "Positive Red"). Lettering to be stenciled not less than 3 inches (76.2 mm) and minimum 3/8" stroke.
    a. Stencil to read – "1 HOUR FIRE RATED ASSEMBLY – PROTECT ALL OPENINGS AND PENETRATIONS".

H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

K. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

L. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

N. Field Quality Control: The Owner reserves the right to engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
1. The testing agency will perform appropriate tests as required by the Owner.
2. If tests show material being used does not comply with specified requirements, the Contractor shall remove noncomplying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

O. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

P. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

Q. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
1. At completion of construction activities of other trades, touch up and restore damaged or defaced paint surfaces. Comply with procedures specified in PDCA P1.

R. Paint Schedules: Provide the following paint systems for the various substrates indicated:

3.02 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.

a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils 0 inch (0.03 mm).
   1) Sherwin-Williams B50Z Kem-Bond HS Universal Primer.
   2) Glidden Professional 4160 DevGuard.
   3) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils 0 inch (0.03 mm).
   1) Sherwin-Williams A100A82 Exterior Latex.
   2) Glidden Professional 2416V Ultra-Hide 150 Semi Gloss.
   3) Moore: MoorGlo Latex House & Trim Paint #096.

B. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:
   1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a galvanized metal primer.
      a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils 0 inch (0.03 mm).
         1) Sherwin-Williams B66W1 DTM Acrylic Primer/Finish.
         2) Glidden Professional 4020 Devflex DTM Primer/Finish.
         3) Moore: IronClad Galvanized Metal Latex Primer #155.
      b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils 0 inch (0.03 mm).
         1) Sherwin-Williams A100A82 Exterior Latex.
         2) Glidden Professional 2416V Ultra-Hide 150 Semi Gloss.
         3) Moore: MoorGlo Latex House & Trim Paint #096.

C. Aluminum: Provide the following finish systems over exterior aluminum surfaces:
   1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
      a. Primer: Rust-inhibitive, acrylic- or alkyd-based, metal primer, as recommended by the manufacturer for use over aluminum, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.0 mils 0.01 inch (0.25 mm).
         1) Sherwin-Williams B71Y1 DTM Wash Primer.
         2) Glidden Professional 4020 Devflex DTM Primer/Finish.
         3) Moore: Primer not required.
      b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils 0 inch (0.03 mm).
         1) Sherwin-William A100A82 Exterior Latex.
         2) Glidden Professional 2416V Ultra Hide 150 Semi Gloss
         3) Moore: MoorGlo Latex House & Trim Paint #096.

3.03 INTERIOR PAINT SCHEDULE

A. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:
   1. Semi gloss, Acrylic-Enamel Finish: 2 finish coats over a block filler.
      a. Block Filler: High-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 5.0 mils 0.01 inch (0.13 mm).
         1) Sherwin-Williams B25W25 PrepRite Masonry Primer.
         2) Glidden Professional 3010 Concrete coatings Block Filler.
         3) Moore: Moorcraft Interior & Exterior Block Filler #173.

b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils 0 inch (0.03 mm).
   1) Sherwin-Williams B31 ProClassic Waterbourne.
   2) Glidden Professional 1406N Ultra Hide 250 Semi Gloss.
   3) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex Enamel #333.

B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
   1. Flat Acrylic Finish: 2 finish coats over a primer.
      a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.1 mils 0.03 yard (0.028 meter).
         1) Sherwin-Williams B28W200 PrepRite 200 Interior Latex Primer.
         2) Glidden Professional 1000 High Hide Primer.
         3) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
      b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils 0 inch (0.03 mm).
         1) Sherwin-Williams B30W200 ProMar 200 Interior Flat Latex.
         2) Glidden Professional 1210V Ultra-Hide 150.
         3) Moore: Regal Wall Satin #215.
   2. Semi gloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
      a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.1 mils 0 inch (0.03 mm).
         1) Sherwin-Williams B28W200 Prepite 200 Interior Latex Primer.
         2) Glidden Professional 100 High Hide Primer.
         3) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
      b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils 0 inch (0.03 mm).
         1) Sherwin-Williams B31 ProClassic Waterbourne Semi-Gloss.
         2) Glidden Professional 1406N Ultra Hide 250.
         3) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex Enamel #333.

C. Ferrous Metal: Provide the following finish systems over ferrous metal:
   1. Semigloss, Acrylic-Enamel Finish: One finish coat over an enamel undercoater and a primer.
      a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils 0 inch (0.04 mm).
         1) Sherwin-Williams B66W1 DTM Acrylic Primer/Finish.
         2) Glidden Professional 4020 Devflex DTM Primer/Finish.
         3) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
      b. Undercoat: Alkyd, interior enamel undercoat or semigloss, acrylic-latex, interior enamel, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils 0 inch (0.03 mm).
         1) Sherwin-Williams B31 ProClassic Waterbourne Semi-Gloss.
         2) Glidden Professional 1406N Ultra Hide 250.
         3) Moore: Moore's Alkyd Enamel Underbody #217.
      c. Finish Coat: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils 0 inch (0.03 mm).

1) Sherwin-Williams B31 ProClassic Waterborne Semi-Gloss.
2) Glidden Professional 1406N Ultra-Hide 250.
3) Moore: Moore's Regal AquaGlo Vinyl-Acrylic Latex Enamel #333.

D. Cotton or Canvas Covering over Insulation: Provide the following finish system on cotton or canvas insulation covering:
1. Flat Acrylic Finish: 2 finish coats. Add fungicidal agent to render fabric mildewproof.
a. First and Second Coats: Flat, latex-based, interior paint applied atspreading rate recommended by the manufacturer.
1) Sherwin-Williams B30W200 ProMar 200 Flat Latex.
2) Glidden Professional 1210V Ultra-Hide 150.
3) Moore: Regal Wall Satin #215.

END OF SECTION 09 91 00

SECTION 10 14 00
SIGNAGE AND GRAPHICS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Signage included, as indicated on drawings and as directed by Architect.

1.02 SUBMITTALS

A. In accordance with Division 1, submit for review samples, product data, sign schedule.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. ASI, Signmart

B. South Texas Graphics

C. Texas Marking Products

D. Sign International

E. SPARQ 1200

2.02 MATERIALS

A. Interior signage: Engraved laminated plastic identification, instruction and/or warning signs with contrasting core; colors as selected by Architect from manufacturer's standard range.
   1. Mounting: Surface mount on walls adjacent to doors except as otherwise directed by Architect or indicated on drawings.

B. Exterior Signage: Owner/Architect to choose from full range of colors/finishes.
   1. Building identification signage: Refer to drawings.
   2. Other exterior signs: Refer to drawings.

C. Plaque: Cast aluminum; 18" x 24". Typeface(s), edge detail, background texture, finish and layout as directed by Architect; include Facility name, date, names and titles of Owner, Architect and Contractor. Refer to drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Submit proof of all signage to Owner and Architect prior to fabrication and installation for approval.

B. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Use concealed mounting methods. Install materials and systems in proper relation to adjacent construction and with uniform appearance. Coordinate with work of other sections.

C. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

END OF SECTION 10 14 00

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Protective wall covering.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. AAMA 611 - Specification for Anodized Architectural Aluminum; 2026.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

E. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate for each product indicated.

C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two sections of each model and color specifed, 12 inches (_____ mm) long.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project that are packaged with protective covering for storage and identified with labels describing contents:
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Stock Materials: Two package(s) of minimum 96 inches (2438 mm) long unit of each kind of covers for each type of unit installed.

F. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

G. Embodied Carbon Submittals:
   1. Completely Environmental Product Declaration Reporting Form for each principle product type in this Section.
   2. For products with completely Environmental Product Declaration Reporting Forms claiming availability of an applicable EPD, provide the Product-Specific of Industry-Wide Type III Environmental Product Declaration (EPD) in compliance with ISO 14025 .
   3. The Contractor is advised that the submission of the embodied carbon EPD materials to the USGBC is not required.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide components with flame-spread and smoke-developed indices of not more than 25 and 450, respectively, when tested per ASTM E84 by a testing agency acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Store materials indoors in a clean, dry area protected from damage and in accordance with manufacturer's instructions.

C. Protect materials during handling and installation to prevent damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: The design for each impact-resistant wall protection unit is based on the product named. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. American Floor Products Co., Inc.
   2. Arden Architectural Specialties, Inc.
   3. Balco, Inc.
   4. Boston Retail Products.
   5. Construction Specialties, Inc.
   6. IPC Door and Wall Protection Systems, Inc.
   7. Koroseal Wall Protection Systems, Inc.
   8. K. J. Miller Corp.
   9. Pawling Corporation.
   10. Tepromark International, Inc.
   11. Tri-Guards, Inc.
   12. Wilkinson Company, Inc.
   13. Inprocorp.com, 580 W18766 Apollo Drive, Muskego, WI, 53150. PH: 800.222.5556 www.inprocorp.com.

2.02 PRODUCT TYPES

2.03 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than the strength and durability properties of ASTM B221, alloy 6063-T5.

B. Stainless-Steel Plate: Type 304, minimum 0.0625 inch (1.59 mm) thick.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorroding metal screws, bolts, and other fasteners compatible with aluminum components, hardware, anchors, and other items being fastened. Use vandal-resistant fasteners where exposed to view.

D. Adhesive: Type recommended by manufacturer for use with material being adhered to substrate indicated.
   1. VOC Content: Comply with the following limits when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Gypsum Board and Panel Adhesives: Not more than 50 g/L.
      b. Multipurpose Construction Adhesives: Not more than 70 g/L.
      c. Contact Adhesives: Not more than 80 g/L.

2.04 CORNER GUARDS

A. Stainless-Steel Corner Guards: Paper-covered, satin-finish, 0.050 inch (1.27 mm) minimum, stainless-steel or aluminum sheet corner guards; with 90-deg ree turn, unless otherwise indicated; and formed edges.
   1. Basis-of-Design Product: Acrovyn ACO-.
   2. Wing Size: 3-1/2 inch (89 mm) by 3-1/2 inch (89 mm)
   3. Mounting: Countersunk screws with mounting holes 8 inch (203.2 mm) o.c.
   4. Corner Radius: 1/8 inch (3.18 mm).

2.05 FINISHES

A. Metal Finishes: Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary covering before shipping.
   1. Aluminum: Anodic coating, clear, Class II complying with AAMA 611 .
   2.

2.06 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify by examination that wall surface is acceptable to receive the specified bumper guard. Notify the Architect in writing of wall surfaces are not acceptable. Do not begin installation until acceptable conditions have been corrected.

B. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.02 INSTALLATION

A. Preparation: Complete finishing operations, including painting, before installing impact-resistant wall protection systems components. Before installation, clean substrate to remove dust, debris, and loose particles.

B. Install impact-resistant wall protection system components level, plumb, and true to line without distortions.
   1. Do not use materials with chips, cracks, voids, strains, or other defects that might by visible in the finished Work.

C. Where splices occur in horizontal runs of more than 20 feet (609.6 cm), splice aluminum retainers and plastic covers at different locations along the run.

D. Immediately on completion of installation, clean plastic covers and accessories using standard ammonia-based household cleaning agent. Clean metal components according to manufacturer's written instructions.
   1. Remove excess adhesives using methods and materials recommended by manufacturer.

END OF SECTION 10 26 00

SECTION 10 28 13
TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Toilet accessories; shower accessories; and utility room accessories.

1.02 RELATED SECTIONS

A. Section 04 20 00, Unit Masonry

B. Section 05 40 00, Cold-Formed Metal Framing

C. Section 09 21 16, Gypsum Board Assemblies

D. Section 09 30 13, Ceramic Tile

E. Section 10 21 13.13, Toilet Partitions

F. Division 26 – Electrical

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and technical data.
   2. Manufacturer's installation instructions.
   3. Manufacturer's operation and maintenance instructions of units specified.
   4. Provide schedule of materials and installation locations.

B. Shop Drawings: Indicate size, material and finish. Show locations, installation procedures. Include details of joints, attachments, fasteners, clearances, and mounting heights.

1.04 MINIMUM COMPLIANCE STANDARDS

A. Comply with ANSI A117.1 and Texas Accessibility Standards (TAS) and with referenced standards specified with each product or material.

1.05 QUALITY STANDARDS

A. Design, finish and keying of items shall be the same.

B. Furnish items from one (1) manufacturer only unless otherwise specified or directed by Architect.

1.06 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 00, Project Management and Coordination.

1.07 COORDINATION

A. Coordinate the Work with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.08 WARRANTY

A. Warranty the work specified herein for three (3) years, or provide manufacturer's standard warranty for specified products, against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship.

B. Defects shall include, but not be limited to:
   1. Delamination or deterioration of finish.
   2. Noisy, rough or difficult operation.
   3. Failure to meet specified quality assurance requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers listed whose products meet or exceeds the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience

manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

1. American Specialties, Inc. (ASI)
2. Bobrick Washroom Equipment, Inc.
3. Bradley Corp.

B. Specifications are based on products of Bobrick Washroom Equipment, Inc., (281) 362-7515.

2.02 COMPONENTS

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. Stainless Steel:
   1. Stainless Steel Sheet: ASTM A666 Type 302 or 304.
   2. Stainless Steel Tubing: ASTM A269, stainless steel.
   3. Finish: No. 4 satin, unless otherwise specified.
   4. Thickness: 22 US Stainless gauge minimum.

C. Chromium Plating:
   1. Method: Over nickel.
   2. Standard: ASTM C456, Type SC 2.

D. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof.

E. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

F. Backing: Concealed backing to comply with local codes and as required for substrate conditions; or manufacturers' standard mounting kits.

2.03 FINISHING

A. Stainless Steel: No. 4 satin brushed, typical on all accessories, unless otherwise noted.

B. Baked Enamel: Pre-treat to clean condition, apply one coat primer and minimum two coats vitreous enamel.

C. Chrome / Nickel Plating: Satin finish.

D. Shop Primed Ferrous Metals: Pre-treat and clean, spray apply one coat primer and bake.

E. Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.01 MOUNTING LOCATIONS

A. Comply with ADA and TAS requirements. Refer to drawings. When not shown, submit supplier's recommended for locations and mounting height before proceeding.

B. Contractor shall be responsible for supplying all opening, blocking, and other components necessary for installation of all toilet accessories.

C. Use approved theft-resistant type fasteners.

3.02 SCHEDULE

A. As a quality standard, Model Numbers shown which are not Owner furnished are products of Bobrick Washroom Equipment, Inc. and Bradley Corporation.

RESTROOM ACCESSORIES:

1. Grab Bars: (At Typical Accessible Toilet Stalls)
   a. Size / Finish: 1-1/2 inch (38 mm) diameter Satin Finish Stainless Steel.
   b. Clearance: 1-1/2 inch (38 mm) between rail and wall.
   c. Model No.: B-6806.

d. Mounting: Attach with concealed mounting. Mount parallel to floor.
e. Location: One (1) 36 inch (914.4 mm) behind toilet, and one (1) 42 inch (1066.8 mm) long bar at side of toilet, at each accessible stall. Refer to drawings.

2. L-Shaped Phenolic Shower Seat:
   a. Mounting: Surface
   b. Model B-5171 (right) B-5171 (right)
   c. One (1) at each accessible shower.
3. Mop and Broom Holder:
   a. Mounting: surface.
   b. Model No.: B-239 x 34
   c. Capacity: Four (4) hooks, three (3) mop holders.
   d. Location: One (1) above mop sink. Refer to drawings.
4. Robe Hook with Bumper:
   a. Mounting: Surface.
   b. Model No.: B-6827
   c. Fabrication: Solid aluminum casting with satin finish with hard rubber bumper.
5. L-Shaped Stainless Steel Grab Bar:
   a. Mounting: Surface.
   b. Model B-68137
   c. One (1) at each accessible shower.
6. Shower Curtain Rod, and Hooks:
   a. Mounting: Surface.
   b. Model: B-204-2, B-201-1, B-6827, B-204-2, B-207
   c. One (1) assembly at each shower. Refer to Drawings.
7. ADA Shower Threshold:
   a. Supplier: Trademark Hardware.
   b. Mounting: Surface.
   c. Install (1) at each accessible shower. Reference drawings and field measure for size requirements.
8. Shower Shelf:
   a. Supplier: Schluter Systems.
   b. Mounting: Recessed.
   c. Install (1) at each shower. Field measure for size requirements and coordinate with surrounding tile pattern.

END OF SECTION 10 28 13

SECTION 10 44 00
FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

1.02 SUMMARY

A. Work Included: Portable fire extinguishers and cabinets.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data showing compliance with contract documents.

B. Samples: Finishes of cabinets, on actual or similar material.

C. Operating and Maintenance Data: Instruction manual complying with NFPA 10 requirements.

D. Certification: Installation shall submit written certification that the fire extinguishers installed comply with the contract documents and are fully and correctly charged.

1.04 QUALITY ASSURANCE

A. Provide only fire extinguishers which comply with NFPA 10.

B. Labels: Provide only fire extinguishers which are listed and labeled by Underwriters Laboratories Inc., or Factory Mutual System.

1.05 PROJECT CONDITIONS

A. Do not deliver or install extinguishers until just before substantial completion.

B. Do not use permanent fire extinguishers for construction period fire protection.

1.06 MAINTENANCE

A. Provide a maintenance contract to Owner for a period of 1 year after substantial completion.
   1. Include monthly and annual inspections in accordance with NFPA 10 and OSHA regulations.
   2. Submit reports of inspections to Owner.

PART 2 PRODUCTS

2.01 FIRE EXTINGUISHERS

A. Manufacturers: Products of the following manufacturers, provided they comply with requirements of contract documents, will be among those considered acceptable:
   1. Fire extinguishers:
      a. Ansul Fire Protection/A Grinnell Company.
      b. General Fire Extinguisher Corporation.
      c. Walter Kidde, The Fire Extinguisher Co.

B. Fire Extinguishers:
   1. Rating: 2A:10B:C, 5 pounds capacity.
   2. Type: Multipurpose dry chemical (ammonium phosphate), stored pressure type. 'K' Type in kitchen.
   3. Cabinet mounted unless noted otherwise.
   4. Aluminum cylinder.

2.02 CABINETS AND CABINET ACCESSORIES

A. Manufacturers: Products of the following manufacturers, provided they comply with requirements of contract documents, will be among those considered acceptable:
   1. Cabinets and accessories:
      a. J.L. Industries.
      b. Larsen's Manufacturing Company.

c. Potter-Roemer Division/Smith Industries, Inc.

B. Cabinets:
1. To house one extinguisher.
2. Style: Fully recessed mounted, with trim concealed by door.
3. Single flat door.
a. Narrow vertical glazing panel.
1) Acrylic sheet glazing.
2) Clear.
b. Door material: Stainless Steel.
c. Lever handle, cam action latch.
4. Manufacturer's standard horizontal lettering identifying contents of cabinet.
a. Letters silk screen painted, red.
5. Box: Steel sheet, factory painted.
6. Provide wall bracket for extinguisher inside cabinet.

C. Hinges: Provide hinges for each door; concealed or continuous type; allow full 180 degree opening of door. Finish exposed hinges to match door.

D. Bracket Mounted: Provide bracket mounted extinguishers at apparatus bays.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare openings for recessed cabinets.

3.02 INSTALLATION

A. Perform installation in accordance with the manufacturer's instructions except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Locate extinguishers as directed by Architect.

C. Locate cabinets as directed by Architect.

D. Install cabinets at heights indicated.

E. Install extinguishers.

3.03 OWNER PERSONNEL INSTRUCTION

A. Instruct designated personnel of Owner in:
1. Operation of extinguishers.
2. Frequency of inspection and maintenance.
3. Procedures for inspection and maintenance.
4. Designation of inspection and maintenance entity.

END OF SECTION 10 44 00

SECTION 10 44 13
FIRE PROTECTION CABINETS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

1.02 SUMMARY

A. Section includes fire-protection cabinets for portable extinguishers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fire-protection cabinets.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.05 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 PRODUCTS

2.01 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
   1. Basis of Design: Larsen Architectural Series for Fire Extinguisher Cabinets or Architects approved equal.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Stainless-steel sheet.

D. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

E. Cabinet Trim Material: Stainless-steel sheet.

F. Door Material: Stainless-steel sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer’s standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:
   1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
   2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

K. Materials:
   1. Stainless Steel: ASTM A 666, Type 304.
      a. Finish: No. 4 directional satin finish.
   2. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 0.12 inch (3 mm) thick.

2.02 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply vinyl lettering at locations indicated.

E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 10 44 13

SECTION 10 44 16
FIRE EXTINGUISHERS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

1.02 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.06 COORDINATION

A. Coordinate type and capacity of fir extinguishers with fire-protection cabinets to ensure fit and function.

1.07 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair of replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Six years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, “Portable Fire Extinguishers”.

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.02 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Ansul Incorporated.
      b. JL Industries, Inc.: a division of the Activar Construction Products Group.
      c. Larsens Manufacturing Company.
   2. Valves: Manufacturer’s standard.
   3. Handles and Levers: Manufacturer’s standard.
   4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Fire Extinguishers Installation: General Contractor shall coordinate the installation of portable extinguisher type and spacing based on occupancy as follows:
   1. Multipurpose Dry-Chemical Type: UL-rated 10-16 nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer’s standard enameled container.

a. For A and B Occupancies: Install (1) One portable extinguisher with a minimum rating of 2-A, 10-B:C for each 3,000 s.f. of floor space and within 75 linear feet of any unobstructed path of travel.
b. For F-1 Occupancies: Install (1) One portable extinguisher with a minimum rating of 2-A, 10-B:C for each 3,000 s.f. of floor space and within 50 linear feet of any unobstructed path of travel.

2.03 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Ansul Incorporated.
b. JL Industries, Inc.; a division of the Activar Construction Products Group.
c. Larsens Manufacturing Company.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
a. Orientation: Vertical.

PART 3 EXECUTION

3.01 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharge fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
1. Mounting brackets: 54 inches (1371.6 mm) above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 10 99 00
MISCELLANEOUS SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Flush-mount Corner guards.

B. Related Requirements: Sections 03 30 00 Concrete, 06 10 00 Rough Carpentry, 09 84 13 Acoustical Wall Panels and 09 91 00 Painting.

1.02 SUBMITTALS

A. Product Data: Submit written technical information and installation instructions which demonstrate that products comply with contract documents.

B. Shop Drawings: Submit shop drawings describing materials, fabrication, and installation. Include details of support, anchorage, and accessories.

C. Samples: Submit manufacturer's full range of available finish material, color and texture samples for selection.

D. Contract Closeout Submittals: Submit maintenance data.

1.03 QUALITY ASSURANCE

A. Installer qualifications: A company with installation experience with units similar to those included in this section and authorized or licensed by manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Follow manufacturer's directions for handling products and materials from factory to project site.

B. Packing and Shipping: Pack materials for delivery in manufacturer's standard coverings to protect products from damage during shipping and storage.

C. Storage and Protection: After delivery and before installation store panels on edge and above floor on blocking in a dry and ventilated area, protected from high humidity and temperature extremes.

1.05 COORDINATION

A. Provide coordination data to affected installers of related work. Include location template drawings for items supported by or anchored to substrate construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Corner Guards, unless otherwise indicated:
   1. Typical at all drywall outside corners.
   2. Extruded vinyl flush-mount corner guard 3"x3" 90 degree full height – reference drawings for ceiling heights.
   3. Texture to have a pebblette texture.

B. Accessories: Provide all mounting hardware, accessories and trim necessary for complete installation of miscellaneous specialties.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates on which work will be installed and other conditions affecting the work of this Section.

B. Correct unacceptable substrates and conditions before start of installation.

3.02 INSTALLATION

A. Complete substrate construction and adjacent finish surfaces, including painting, before start of installation.

B. Install product in accordance with manufacturer's written directions.

C. Install in configurations indicated on the drawings.

D. Corner Guards: Install at all interior gypsum drywall external corners.

E. Correction of Defective Work: Replace broken, chipped, deformed, or otherwise damaged components.

3.03 CLEANING

A. Clean installed work of this section and adjacent surfaces before final acceptance. Use cleaning materials and methods recommended by partition manufacturer.

B. Remove work debris from project site.

C. Protect against damage or dirt after installation and until date of substantial completion.

END OF SECTION 10 99 00

SECTION 11 30 13
RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Kitchen appliances.
   1. 60" Range
   2. Dishwasher.
   3. UnderCounter Ice Machine
   4. Washer Dryer

1.02 RELATED REQUIREMENTS

A. Section 26 05 83 - Wiring Connections: Electrical connections for appliances.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's Specifications and data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.
   1. Manufacturer’s installation instructions.
   2. Manufacturer’s operation and maintenance instructions.

C. Samples or color charts showing manufacturer’s full range of colors.

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

A. Range: LP gas, free-standing, sealed burners.
   1. Quantity: 1.
   2. Size: 60" _____ wide.
   3. Oven: Self-cleaning with electronic ignition.
   4. Elements: Four (4).
   5. Controls: Push-to-turn knobs with electronic clock and timer.
   6. Features: Include automatic meat thermometer, storage drawer, oven door window, broiler pan and grid, oven light, and ____.
   7. Exterior Finish: Porcelain enameled steel, color as indicated.
   8. Manufacturers:
      a. Thor: Model LRG60ELP or equivolent

B. Dishwasher, Type ____: Undercounter.
   1. Color: Stainless Steel.
   2. Quantity: 2.
   3. Controls: Solid state electronic.
   4. Wash Levels: Three (3).
   5. Cycles: Six (6), including normal, rinse and hold, short, china/crystal, pot and pan, and ____.
   6. Features: Include rinse aid dispenser, optional no-heat dry, optional water temperature boost, adjustable upper rack, adjustable lower rack, and ____.
   7. Finish: Porcelain enameled steel , color as indicated.
   8. Manufacturers:
      a. GE Appliances: Model GDT550PYRFS or equivalent; ____

C. Undercounter Icemachine
   1. Color: Stainless Steel.
   2. Quantity: 1
   3. Manufacturers:
      a. Whirlpool: Model WUI75X15HZ or equivalent.

2.02 LAUNDRY APPLIANCES

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are provided, proper opening sizes, correctly located, and that areas are ready to receive appliance installation.

B. Ensure that proper utilities are in place.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.03 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.04 CLEANING

A. Clean appliances and equipment of dirt, dust, fingerprints and markings detrimental to good appearance.

B. Remove packing materials from equipment and properly discard.

C. Wash and clean equipment.

END OF SECTION 11 30 13

SECTION 12 49 20
MANUAL OPERATED ROLLER SHADE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Roller Shade.

B. Related Work includes the following:
   1. Section 06100 Rough Carpentry
   2. Section 08520 Aluminum Windows
   3. Section 079200 “Joint Sealants” for sealing the perimeters of installation accessories for light-blocking shades with a sealant.
   4. Section 107113 “Exterior Sun Control Devices” for exterior shade systems.
   5. Section 122200 “Curtains and Drapes” for wired-, radio-, and networked-motor-operated soft window coverings.
   6. Section 122509 “Window Treatment Motors, Controls, and Networked Automation Systems” for other motor operators and motor controls.
   7. Section 260519 “Low-Voltage Electrical Power Conductors and Cables” for power cables.
   8. Section 260523 “Control-Voltage Electrical Power Cables” for balanced twisted pair cabling.
   9. Section 260943.16 “Addressable-Luminaire Lighting Controls” for lighting integration into digital shading systems.
   10. Section 260943.23 “Relay-Based Lighting Controls” for lighting integration into digital shading systems.
   11. Section 262726 “Wiring Devices” for accessory electrical wiring devices.

1.02 REFERENCES

A. National Fire Protection Association (NFPA) 701.

B. Department of Transportation Motor Vehicle Safety Standard 302 Flammability of Interior Materials.

C. California Administrative Code Tide 19.

D. Federal Standard 191 Method 5903 (used by Port Authority of New York and New Jersey for drapery, curtain, and upholstery material).

E. Boston Fire Department Test BFD IX-1.

F. New York State Uniform Fire Prevention and Building Code.

1.03 SUBMITTALS

A. Subject under provisions of Section 01330 – Submittal Procedures.

B. Product Data: Manufacturer’s data sheets shall be submitted for each product specified, including:
   1. Preparation instructions and recommendations.
   2. Finishes, material descriptions, dimensions of individual components.
   3. Construction and installation instructions.
   4. Manufacturers recommendations for maintenance and cleaning

C. Drawings and Diagrams: Product details, installation details, working and assembly drawings shall be supplied as requested.

D. Sample: Responsible contracting officer or agent shall supply one sample shade of each type specified in this contract for approval. Supplied units shall be furnished complete with all required components, mounting and associated hardware, instructions and warranty.

E. Electric shade motors shall comply with UL standards. Copy of compliance availability for submission upon request.

1.04 QUALITY ASSURANCE

A. Supplier: Manufacturer, subsidiary, or licensed agent shall be approved to supply the products specified, and to honor any claims against product presented in accordance with warranty.

B. Installer: Installer or agent shall be qualified to installed specified products by prior experience, demonstrated performance and acceptance of requirements of manufacturer, subsidiary, or licensed agent. Installer shall be responsible for an acceptable installation.

C. Uniformity: Provide product of only one manufacturer for entire project.

D. Mock Up. Provide one (1) mock-up shade for each roller shade type/assembly specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Product shall be delivered to site in manufacturer's original packaging.

B. Product shall be handled and stored to prevent damage to materials, finishes, and operating mechanisms.

1.06 JOB CONDITIONS

A. Prior to shade installation, building shall be enclosed.

B. Interior temperature shall be maintained between 60 degrees Fahrenheit and 90 degrees Fahrenheit during and after installation; relative humidity shall not exceed 80%. Wet work shall be complete and dry.

1.07 WARRANTY

A. Provide a limited manufacturer's warranty from date of Substantial Completion covering the following periods.

1. Lifetime Limited Warranty on all hardware components, fabrics warrantied for 5 years by Hunter Douglas, and most fabrics warrantied for 10 years by the fabric manufacturer. Specified and custom product warranties available from manufacturer or its authorized agent.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Hunter Douglas Architectural Window Coverings – Justin Pratt, 13915 Danielson Street, Suite 100, Poway, CA 92064; Phone: 214-499-5513; Website: www.hunterdouglasarcitectural.com/windowcoverings; or architect approved equivalent.

B. Request for substitutions must be approved by architect prior to close of bid.

2.02 MANUAL ROLLER SHADE

A. Fabrics: Inherently anti-static, flame retardant, fade and stain resistant, light filtering, room darkening, and blackout fabrics providing 0% to 20% openness, 5 oz/sq. yd. to 20.70 oz/sq. yd., containing fiberglass, PVC, polyester, acrylic, vinyl laminates, cotton, and vinyl coatings (based upon fabric choice). Finish selected by architect from manufacturer's available contract colors.

1. Horizontal stabilizing battens are not required, nor will they be accepted.

B. Control Systems:

1. Clutch Operated: Chain-driven operator capable of lifting up to 20 pounds of weight with a maximum allowable pull force of 10 pounds. Utilization of adjustment-free continuous qualified T304 stainless ball chain with 110 lbs. breaking strength for precise control, smooth operation, and ensures a uniform look. Components must be maintenance-free from adjustments or lubrication for trouble-free lifetime operation.
   a. 90 pound breaking strength chains will not be acceptable.
   b. Chain anchor device to be compliant with WCMA safety standard A100.1.1-2010 and must prevent the clutch system from moving the roller shade through lowering and raising if not properly installed as specified in ANSI Standard Section 6.5.2.

2. Roller Tube: Circular-shaped aluminum tube extruded from alloy and temper 6063 T-6. Extruded tube to have a .063” wall thickness (2.5” outside diameter to have a 0.79” wall thickness). Heavily reinforced with minimum of six internal ribs and flutes providing additional tensile strength and allows for secure placement of clutch and end plug.
3. Spring-Loaded Idle End: Reinforced idler assembly containing spring loaded end plug with positive locking wheel allowing for up to 7/8” adjustment and provides for a secure installation and removal of shade. Locking tube bearing plug contains minimum 6 ribs and flutes and inserted a minimum of 2 3/8” into roller tube on heavy duty systems.
4. Bottom Bar: Industry standard sealed hembar with weight sewn into pocket providing for tracking adjustments and uniform look of the hanging fabric panel. RB500 Bottom Bar with wool pile.
5. Mounting Hardware: Manufacturer’s standard or heavy duty bracket constructed of hardened 1/8” thick steel to support full weight of shade with bracket and screw hole covers to provide uniform look. Locking mechanism on bracket adapter provided for a secure installation and removal of the shade.
   a. Cradle-seated hardware without a locking mechanism will not be accepted.
6. Integrated Leveling Device: Built into the idle-end bracket (or intermediate bracket of a coupled shade) allowing for the vertical height adjustment of +/- one-half inch direction up or down, allowing the easy leveling of a fabric panel on its mounting surface. This assists to keep the fabric rolling square to the tube, minimizing the chance of the fabric rolling into its hardware causing creases and damage to the ends of the fabric.
   a. Adjusting fabric skewing through means of tape, paper, or cardboard tucked up inside the fabric at the tube is not acceptable.
7. Fascia: L-shaped removable aluminum extrusion valance that attaches to brackets and conceals roller shade. Fascia at the bottom enclosure must allow a maximum of 1” gap to allow fabric to come through. Exposure underneath greater than 1” is not to be accepted.
8. Blockout System: Extruded aluminum side channel with concealed mounting brackets. Bottom bar with Nylon wool pile to prevent light leakage.
9. Coupling Or Banding: Coupling is utilized when more than one fabric tube assembly is mechanically linked with adjacent panels, allowing a single operator to move multiple panels of fabric. Banding is utilized when multiple panels of fabric are placed on the same tube.

2.03 FABRICATION

A. Shade measurements shall be accurate to within +/- 1/8” or as recommended in writing by manufacturer.

2.04 FABRICS

A. PVC-coated fiberglass or PVC-coated polyester.

PART 3 EXECUTION

3.01 INSPECTION

A. Subcontractor shall be responsible for inspection on site, approval of mounting surface, installation conditions, and field measurement for this work.

B. Other interacting trades shall receive drawings of shade systems, dimensions, assembly, and installation methods from subcontractor upon request.

3.02 INSTALLATION

A. Installation shall comply with manufacturer’s specifications, standard and procedures as detailed on contract drawings.

B. Adequate clearance shall be provided to permit unencumbered operation of shade and hardware.

C. Clean finish installation of dirt and finger marks. Leave work area clean and free of debris.

3.03 DEMONSTRATION

A. Demonstration operation method and instruct owner's personnel in the proper operation and maintenance of the roller shades.

3.04 SCHEDULES

A. See drawings for locations.

END OF SECTION 12 49 20

SECTION 13 34 19
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufacturer-engineered, shop-fabricated structural steel building frame.
   1. All exterior metal shall be galvalume finished as specified and all exterior fasteners shall be corrosion resistant.

1.02 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022, with Errata (2025).

B. AISC 360 - Specification for Structural Steel Buildings; 2022, with Errata (2025).

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

H. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2026.

I. ASTM A568/A568M - Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for; 2025a.

J. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2025.

K. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

L. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

M. ASTM C991 - Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings; 2025a.

N. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

O. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

Q. MBMA - Metal Roofing Systems Design Manual; 2012.

R. MBMA (MBSM) - Metal Building Systems Manual; 2024.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on profiles, component dimensions, fasteners.

C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections and attachments; wall and roof system dimensions, panel layout, general construction details, anchors and methods of anchorage, _____, and installation; framing anchor bolt settings, sizes, locations from datum, and foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

D. Samples: For factory-applied color finishes.

E. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
   1. Name and location of Project.
   2. Order number.
   3. Name of manufacturer.
   4. Name of Contractor.
   5. Building dimensions and roof slope.
   6. Indicate compliance with AISC and AISI standards.
   7. Governing building code and year of edition.
   8. Design loads and load combinations.
   9. Building-use category and its effect on load importance factors.
   10. Statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

F. Certification that roof will remain watertight at slopes indicated.

G. Surveys: Show final elevations and locations of major members. Engage a qualified engineer or land surveyor to perform surveys and certify their accuracy.

1.04 QUALITY ASSURANCE

A. System Performance Requirements: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior. Include primary and secondary framing, roof panels, supporting members for exterior wall and canopies, and accessories complying with requirements indicated.
   1. Structure compliant with International Building Code (IBC), latest edition approved by authorities having jurisdiction.
   2. Metal Building System Design: Of size, spacing, slope, and spans indicated.
   3. Structural Performance: Engineer metal building systems according to procedures in MBMA 's "Low Rise Building Systems Manual".
   4. Thermal Movements: Provide metal building roof and wall panel systems that allow for thermal movements resulting from maximum change (range) in ambient and surface temperatures.
   5. Wind-Uplift Resistance: Reference Structural Documents.

B. Regulatory Requirements: Fabricate and label structural framing to comply with special inspection requirements at point of fabrication for welding and other connections required by authorities having jurisdiction.

C. Coordinate size and location of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete".

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide 10 year manufacturer warranty for covering the cost of labor and materials to repair or replace pre-engineered building systems or components which are found to be defective or nonconforming in materials or workmanship.. Coverage shall include, but not be limited to, the following:
   1. Failure for roof to remain watertight, 2-years.
   2. Leaking, rupture, rusting, structural failure or perforation of roof panels and accessories, including panels, gutters, downspouts, trim and accessories, 2-years.

C. Provide manufacturer's 20-years warranty for the panel and trim finish coating system, covering blistering, peeling, cracking, flaking, checking, chipping, fading, and chalking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Buildings Systems:
   1. Robert S. Henry Company
   2. Rigid Building Systems
   3. Alliance Steel
   4. Mid-West Steel Building Company
   5. USA (United Steel of America)

2.02 ASSEMBLIES

A. Single span rigid frame.

B. Primary Framing: Rigid frame of rafter beams and columns, canopy beams, and wind bracing.

C. Secondary Framing: Purlins, and other items detailed.

2.03 PERFORMANCE REQUIREMENTS

A. Installed Thermal Resistance of Wall System: R-value of ____ (RSI-value of ____).

B. Installed Thermal Resistance of Roof System: R-value of ____ (RSI-value of ____).

C. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

D. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of ____ degrees F (____ degrees C).

2.04 MATERIALS

A. Structural-Steel Shapes: ASTM A36/A36M or ASTM A529/A529M .

B. Steel Plate, Bar, or Strip: ASTM A529/A529M , ASTM A570/A570M, or ASTM A572/A572M ; 50,000-psi minimum yield strength.

C. Steel Tubing or Pipe: ASTM A500/A500M, Grade B; ASTM A501/A501M; or ASTM A53/A53M, Grade B.

D. Structural-Steel Sheet: Hot-rolled, ASTM A570/A570M, Grade 50 or Grade 55; hot-rolled, ASTM A568/A568M ; or cold-rolled, ASTM A611, structural-quality, matte (dull) finish.

E. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M , alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

F. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307 , Grade A (ASTM F568M, Property Class 4.6); carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers, uncoated.

G. High-Strength Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

H. Fasteners Exposed to Exterior: factory-coated steel fasteners complying with corrosion-resistance provisions in FMG 4470, designed for fasteners to substrate.

I. Anchor Rods, Bolts, Nuts, and Washers: As follows:
   1. Unheaded Rods: ASTM A36/A36M .
   2. Unheaded Rods: ASTM A572/A572M , Grade 50.
   3. Headed Bolts: ASTM A307 , Grade A (ASTM F568, Property Class 4.6); carbon-steel, hex-head bolts; and carbon-steel nuts.
   4. Headed Bolts: ASTM A325 (ASTM A325M), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
   5. Headed Bolts: ASTM A490 (ASTM A490M). Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.
   6. Washers: ASTM A36/A36M .

J. Primer: SSPC-Paint 25; red iron oxide, zinc oxide, raw linseed oil and alkyd primer.

K. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; ½-inch wide and 1/8-inch thick.

L. Joint Sealant: ASTM C920 ; one-part elastomeric polyurethane, polysulfide, or silicone-rubber sealant; of type, grade, class, and use classifications required to seal joints in panels and remain weathertight; and as recommended by metal building system manufacturer.

2.05 INSULATION MATERIALS

A. Vinyl Faced Glass-Fiber-Blacket Insulation: Thermal insulation, complying with ASTM C991 , Type II, of 0.5-lb/cu. ft. density, 6" thick (R30), with a flame-spread rating of 25 or less, and 2-inch- wide, continuous, vapor-tight edge tabs.

2.06 MISCELLANEOUS MATERIALS

A. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

B. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, non-staining grout, complying with ASTM C1107/C1107M, of consistency suitable for application.

C. Finish Painting: Refer to Division 9 Section "Painting".

2.07 STRUCTURAL FRAMING

A. Manufacturer's standard framing designed to withstand required loads and specified requirements and as follows:

1. Fabrication: Shop-fabricate framing components to indicated size and section with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly. Shop prime with specified primer after fabrication.
   a. Tolerances: Comply with MBMA 's "Low Rise Building Systems Manual": Chapter IV, Section 9, "fabrication and Erection Tolerances".
2. Primary Framing: Includes transverse frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
   a. Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
   b. Frame Configuration: As indicated.
3. End-Wall and Corner Columns: I-shaped straight shaft sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0747 inch (1.9 mm).
4. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch (1.52 mm)
5. Secondary Framing: Fabricate from cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet prepainted with coil coating, unless otherwise indicated, to comply with the following:
   a. Purlins: C- or Z-shaped sections; fabricated from minimum 0.0598-inch- thick steel sheet, built-up steel plates, or structural-steel shapes; minimum 2-1/2-inch- wide flanges; depth as indicated.
   b. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598-inch- thick steel sheet, built-up steel plates, or structural-steel shapes.
   c. Flange and Sag Bracing: Minimum 1-5/8-by-1-1/8-inch structural-steel angles, with a minimum thickness of 0.0598 inch (1.52 mm) .
   d. Base or Sill Angles: Minimum 3-by-2-by-0.0747-inch zinc-coated (galvanized) steel sheet.
   e. Purlin Clips: Minimum 0.0747-inch- thick, zinc-coated (galvanized) steel sheet.
   f. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0747-inch- thick, zinc-coated (galvanized) steel sheet.

g. Framing for Openings: Channel shapes; fabricated from minimum 0.0598-inch- thick, cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings, and head, jamb, and sill of other openings.
h. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

6. Bracing: Provide adjustable wind bracing as follows:
a. Rods: ASTM A36/A36M ; ASTM A572/A572M , Grade D; or ASTM A529/A529M , Grade 50; ½-inch- diameter steel; threaded full length or threaded a minimum of 12 inch (304.8 mm) at each end.
b. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.

2.08 ROOF PANELS

A. Panels complying with the following:
1. Standing-Seam Flat Roof Panels complying with Section07 41 13 .
2. Roof Panel Accessories: Provide components required for a complete roof panel assembly. Match materials and finishes or roof panels.

2.09 LINER, FASCIA AND SOFFIT PANELS

A. Panels complying with the following:
1. Liner, Fascia and Soffit Panels complying with Section 07 42 13 .

2.10 DOORS AND FRAMES

A. Personnel Doors: Refer to Division 8 Section "Steel Doors and Frames".

B. Overhead Sectional Doors: Refer to Division 8 Section "Overhead Coiling Doors".

2.11 WINDOWS

A. Aluminum Windows: Refer to Division 8 Section "Glazed Systems".

2.12 ACCESSORIES

A. Metal building system manufacturer's standard units, fabricated from galvalume sheet pre-painted with coil coating, of thickness indicated; in same finish as roof panels.
1. Fasteners: Provide fasteners with heads matching color of roof or wall sheets by means of plastic caps or factory-applied coating.
2. Flashing and Trim: 0.0179-inch metal thickness. Provide flashing and trim as required to seal against weather and to provide finished appearance.
3. Gutters and Downspouts: 0.0179-inch metal thickness, sized according to SMACNA's "Architectural Sheet Metal Manual". Furnish gutter supports spaced 36 inch (914.4 mm) o.c. fabricated from same metal as gutters. Finish gutters and downspouts to match roof fascia and rake trim.
a. Tie downspouts into underground drainage.
4. Louvers: Refer to Division 10 Section "Louvers".
5. Closures: Closed-cell, laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or pre-molded to match roof and wall panel profile.
6. Pipe Flashing: Pre-molded, EPDM pipe collar with flexible aluminum ring bonded to base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position. Verify compliance with requirements and metal building system manufacturer's tolerances.

3.02 ERECTION - METAL BUILDING SYSTEM

A. Erect metal building system according to manufacturer's written instructions, erection drawings, and the following:

1. Baseplates and Bearing Plates: Clean concrete and masonry bearing surfaces and roughen surfaces before setting baseplates and bearing plates.
   a. Set baseplates and bearing plates for structural members on wedges, shims, or setting nuts.
   b. Tighten anchor bolts after supported members have been positions and plumbed.
   c. Pack grout solidly between bearing surfaces and plates so no voids remain.

3.03 ERECTION - FRAMING

A. Erect framing in accordance with AISC 360.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.

C. Align and adjust framing members before permanently fastening to compensate for discrepancies in elevations and alignment. Erect framing true to line, level, plumb, rigid, and secure.

D. Set column base plates with non-shrink grout to achieve full plate bearing.

E. Do not field cut, drill or alter structural members without approval from metal building system manufacturer's professional engineer.

F. Maintain structural stability of frame during erection.

G. After erection, prime welds, abrasions, and surfaces not shop primed.

H. Primary Framing and End Walls: Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist cure grout for not less than seven days after placement.
   1. Make field connections using high-strength bolts. Tighten bolts by turn-of-the-nut method.

I. Secondary Framing: Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts. Hold rigidly to a straight line by sag rods.
   1. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

J. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

K. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

L. Provide all framing for canopies.

M. Provide connections/bracing/framing to support lateral loads imposed on exterior walls.

3.04 ERECTION - WALL AND ROOF PANELS

A. Roof Panel Installation: Provide roof panels of full length from eave to rigde when possible. Install panels perpendicular to purlins. Rigidity fasten eave end of roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels. Fasten roof panels to purlins at location and spacing determined by manufacturer. Flash and seal roof panels with weather closures at eaves, rakes, and at perimeter of all openings.
   1. Standing-Seam Roof Panels: Fasten roof panels to purlins with concealed clips at each standing-seam joint. Install clips over top of insulation.
   2. Reference Section 07 41 13 - Metal Roof Panels for product information and execution.

B. Install in accordance with manufacturer's instructions.

C. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

D. Fasten cladding system to structural supports, aligned level and plumb.

E. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place side laps over bearing.

F. Provide expansion joints where indicated.

G. Use concealed fasteners.

H. Install sealant and gaskets, providing weather tight installation.

3.05 ERECTION - FASCIA AND SOFFIT PANEL

A. Provide panels full width of fasciae and soffits. Install panels perpendicular to support framing.
   1. Fascia Panels: Align bottom of panels. Flash and seal panels with weather closures where fascia meet soffits, along lower panel edges, and at perimeter of all openings.
   2. Soffit Panels: Flash and seal panels with weather closures where soffit meets walls and at perimeter of all openings.
   3. Reference Section 07 42 93 - Soffit Panels for product information and execution.

3.06 ERECTION - BLANKET INSULATION

A. Install insulation concurrently with panel installation, according to manufacturer's written instructions and as follows. Install blankets straight and true in one-piece lengths. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated. Do not obstruct ventilation spaces, except for firestopping. Tape joints and ruptures in vapor retarder and seal each continuous area of insulation to surrounding construction to ensure airtight installation. Comply with the following installation method:
   1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Hold in place by panels fastened to secondary framing.
   2. Over-Purlin-with-Spacer-Block Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing members. Install layer of filler insulation over first layer to fill space formed by roof panel standoffs. Hold in place by panels fastened to standoffs.
   3. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.07 INSTALLATION - ACCESSORY COMPONENTS IN WALL SYSTEM

A. Install door frames, doors, overhead doors, windows and glass, gutters, downspouts, ventilators, louvers, and and other accessories in accordance with manufacturer's instructions and SMACNA's "Architectural Sheet Metal Manual", with positive anchorage to building and weathertight mounting.

B. Coordinate installation with flashings and other components.

C. Provide for thermal expansion of metal units; conceal fasteners where possible and set units true to line and level as indicated.

D. Tie downspouts to underground drainage system indicated.

3.08 TOLERANCES

A. Structural-Steel Erection Tolerances: Comply with erection tolerance limits of AISC 303 , "Code of Standard Practice for Steel Buildings and Bridges".

3.09 SOURCE AND FIELD QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform quality-control testing and special inspections, and to prepare test reports.
   1. Special inspections of shop fabrications will not be required when fabrication is performed by a fabricator registered and approved by authorities having jurisdiction to perform such work without special inspection.
   2. Shop- and field-bolted connections will be visually inspected.

3. Shop- and field-bolted connections will be trusted and inspected according to RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
4. Shop- and field-bolted connections will be tested and inspected according to RCSC's "Load and Resistance Factor Design Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".
5. In addition to visual inspection, shop welding will be inspected and tested according to AWS D1.1/D1.1M.

B. Metal building manufacturer's representative to provide periodic onsite inspections throughout construction and shall provide written documentation to owner stating that the building has been constructed as designed. Inspection shall include, but not be limited to the following: main frame erection, secondary framing erection and roof panel installation.

C. General Contractor to engage a qualified independent testing agency to perform air leakage testing and special inspections, and to prepare test reports. Testing to include either blower door or smoke testing.

3.10 ADJUSTING AND DAMAGE

A. After completing installation, including work by other trades, lubricated, test, and adjust doors, windows, and accessory units to operate easily, free from warp, twist, or distortion.

B. Damaged Panels: Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

C. Touchup Painting: Immediately after erection, clean, prepare, and prime or re-prime welds, bolted connections, and abraded surfaces of prime-painted primary and secondary framing, accessories, and bearing plates. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint.
1. Repair damaged coil coating on exposed surfaces with touch-up paint approved by coating manufacturer for touch-up use.

3.11 WIND LOAD CERTIFICATION

A. Provide certification from an independent structural engineer in good standing certifying that the metal building system has been designed and constructed to comply with the more stringent of building code specified wind load or as noted on drawings.

END OF SECTION 13 34 19

SECTION 21 00 00

FIRE PROTECTION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the fire protection piping, valves, hose connections, and equipment covered by this Section, with all appurtenances, ready for owner's use.

1.3 RELATED WORK

A. Section 21 02 01 - Coordination Drawings

B. Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment

C. Section 21 13 16 - Dry Pipe Sprinkler Systems

1.4 REFERENCES

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe

C. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

D. FM Global Fire Protection Standards

E. NFPA 13 - Standard for the Installation of Sprinkler Systems

F. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems

G. UL - Underwriters Laboratories

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer's name and country of origin.

D. Domestic Manufacture: All valves, pipe, fittings, hose connections, and equipment shall be by a domestic manufacturer.

1.6 SUBMITTALS

A. Submit shop drawings in accordance with Section 22 02 00 and as described below.

B. Submit shop drawings of entire water-based building fire protection system with all standpipe, hose valve, and hose connection locations, including the accompanying hydraulic calculations to the Architect/Engineer for review. **A current and fully documented fire hydrant flow test must be included.**

C. Submit complete product data for 21 31 13 - Fire Pumps, Electric Drive concurrently with the submittal for this Section, for all systems served by such equipment.

D. Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground work.

E. Submit product data to include pipe materials, pipe fittings, valves, hose connections, waterflow and alarm devices, and other appurtenances. Provide manufacturer's catalog information, product certifications, and **country of origin**. Indicate valve data and ratings.

1.7 REGULATORY REQUIREMENTS

A. Work in accordance with:

1. NFPA 13 - Standard for the Installation of Sprinkler Systems.
2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems
3. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances
4. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
5. Local codes that have jurisdiction.

B. Products in accordance with:

1. UL (Underwriters Laboratories) listed.
2. FM (Factory Mutual) approved.
3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.8 CERTIFICATE OF TESTING

A. Furnish Owner with test certificate certifying the system approved by:

1. Fire Marshal.
2. Insurance Services Officials.

PART 2 - PRODUCTS

2.1 GENERAL

A. Work included:

1. Design, coordination, furnishing, and installation of inside and outside piping, valves, hose connections, drain and test risers, hangers, supports, and sleeves.
2. The standpipe system to be provided shall be an **automatic wet standpipe system** to serve all required stairways for the entire building unless specifically indicated otherwise.
   a. The Contract Drawings indicate the general extent and arrangement.
   b. The Contract Drawings identify water supply, pipe routing, control valves, and hose connections.
   c. The fire protection contractor shall make a final determination whether additional hose connections and associated piping are required and shall provide accordingly.
   d. For sprinklered buildings, the system may be a combined system.
   e. Permanently installed drain risers shall be provided at each standpipe equipped with pressure-regulating devices.
   f. All standpipes shall be provided with a means of draining and shall be arranged to discharge water at an approved location.
3. The Drawings provide a preliminary layout with locations of water service entry/water supply, control valves, hose connections, and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.
4. Coordinate work and installation with electrical and fire alarm contractors accordingly to interface system with the building fire and smoke alarm systems.
5. The Drawings provide a preliminary layout with locations of hose connections and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.
6. Coordinate work and installation with electrical and fire alarm contractors accordingly to interface system with the building fire and smoke alarm systems.

B. Requirements:

1. Materials and installation to meet or exceed the requirements of NFPA 13 and 14, (prevailing editions) and the local authority having jurisdiction (AHJ).
2. All components of the system shall be UL listed for the intended service.
3. Provide components with minimum pressure ratings as suited for system working pressure(s).
4. All hose connections shall be provided with approved threads, caps, and chains.

2.2 VALVES

A. General Requirements:

1. Valves shall be rated for no less than 175 psi.
2. All valves controlling connections to water supplies and to standpipes shall be listed indicating valves.
3. Drain and test valves shall be approved.
4. All control, drain, and test connection valves shall be provided with permanently marked weatherproof metal identification signs.
5. Provide as indicated on the Drawings and configured in accordance with the requirements of the local Authority Having Jurisdiction.

B. Gate valves

1. Gate valves shall be UL listed, FM approved bronze trimmed resilient wedge gate type.
2. Provide bronze bodied, rising stem, inside screw type for sizes 2" and smaller. Provide ductile iron bodied, rising stem, outside screw and yoke type for sizes 2-1/2" and larger.
3. Acceptable manufacturers:
   a. Mueller Company
   b. Kennedy Valve
   c. Clow Valve Company
   d. Nibco

C. Check valves

1. Check valves shall be UL listed, FM approved ductile or cast iron bodied, bronze or stainless fitted, non-slam type, suited for horizontal or vertical installation.
2. Acceptable manufacturers:
   a. Mueller Company
   b. Kennedy Valve
   c. Clow Valve Company
   d. Nibco
   e. Tyco-Grinnell

D. Drain and trim valves shall be UL listed, bronze body and bonnet, with bronze stem and packing nut, and aluminum handwheel handle, by Nibco.

2.3 PIPE AND FITTINGS

A. All standpipe piping above grade shall be:

1. ASTM A53/A53M schedule 40 black steel pipe with roll-grooved ends, joined with mechanical couplings and cut groove cast iron 300 psi rated fittings.

B. Acceptable manufacturers:

1. Wheatland Tube Company
2. Bull Moose Tube Company
3. Tex-Tube
4. Allied Tube

C. Acceptable mechanical coupling manufacturers:

1. Victaulic
2. Tyco-Grinnell
3. Anvil-Gruvlok

2.4 FIRE HOSE VALVES, CONNECTIONS, AND EQUIPMENT

A. General requirements: All hose valves shall be listed. All hose connections shall be provided complete with connections, caps and chains conforming to local Fire Department requirements.

B. Acceptable Manufacturers:

1. Potter-Roemer
2. Dixon
3. Elkhart Brass
4. Croker

C. STANDPIPE HOSE VALVES: Female to male, straight or angle pattern as necessary to minimize intrusion into stair traffic area while ensuring clearance for connectivity and valve operation. Provide pressure regulating type (complete with visual indicator) as necessary, based on design and system pressure to ensure compliance with NFPA 14 maximum pressure requirements. 2-1/2” cast brass valve with red metal wheel handle and 1-1/2” reducer. Potter-Roemer Model 4065 or similar model with features as required and as described above.

D. ROOF MANIFOLD: Where there is no stairway access to the roof to provide a highest landing hose connection at this elevation, a hose connection shall be provided on the roof. Provide in accordance with NFPA 14 requirements for roof outlet piping, complete with hose valve, indicating control valve and ball drip connection to drain. Minimum two-way type cast brass body, Potter Roemer 5870 series with 2-1/2” hose valves.

E. FIRE DEPARTMENT CONNECTIONS: No less than 4” and two-way type, with additional connections and in larger size in accordance with system demand per NFPA. Polished chrome plated brass with lettering consistent with system type and service. Back, top, or bottom outlet as required for placement and wall construction for building mounted variations. Provide complete with accessibly located, listed check valve with approved automatic drip valve. Potter-Roemer Model 5751 (building mounted), Model 5761 (free-standing) or similar model with features as required and as described above.

PART 3 - EXECUTION

3.1 DESIGN

A. The Contractor shall conform to the requirements of NFPA 14 for standpipe and hose system design and installation. It shall be the Contractor's responsibility to determine if any deficiency or deviations exist, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

3.2 INSTALLATION

A. Install all items in accordance with applicable codes.

B. Piping shall be protected accordingly where subject to mechanical damage and/or fire damage.

C. Do not install risers or mains in MDF/IDF/Data closets or electrical rooms. Where sprinkler protection is provided, only the associated branch lines and sprinkler heads shall be allowed in such spaces.

D. Piping (mains and standpipes) shall be protected accordingly from freezing temperature with the use of supervised and listed heat tracing with insulation and jacketing.

E. In all locations subject to corrosive conditions, ensure to provide a suitable epoxy (spray) coating to all exposed surfaces of pipe and fittings. All job-applied protective coatings shall be provided as approved and only after verification that the proper piping has been installed, per the markings along the length of the pipe.

F. Piping in finished spaces shall be routed concealed. This shall not include areas such as mechanical spaces, parking garages, and stairways. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.

G. All standpipes shall be provided with a means of draining and shall be arranged to discharge water at an approved location.

H. Identify all locations requiring coordination with the electrical and fire alarm contractors accordingly to ensure connectivity with the building fire and smoke alarm systems. This shall include, but is not necessarily limited to, the following: water flow switches, alarm bells, and tamper/supervisory switches at control valves.

I. At building expansion joints provide approved system expansion joint fittings/assemblies accordingly and per manufacturer's recommendations and NFPA 13 requirements. Victaulic Style 155 carbon steel expansion joint for sizes up to and including 12" pipe.

3.3 PAINTING AND PIPE IDENTIFICATION

A. Painting of fire protection piping and appurtenances shall be provided as follows:

1. Surfaces to be painted shall be cleaned as necessary to ensure they are free from dirt and oils.
2. Unless directed otherwise by Architect, heat and water resistant, air-cured, high performance one-part epoxy paint shall be provided. Coating shall be high-gloss, lead-free, suited for indoor and outdoor use, and USDA approved. Armor-Poxy or similar.
3. Exposed fire sprinkler risers and associated alarm valves and related piping shall be painted red.
4. Exposed fire protection and sprinkler piping in finished areas shall be painted as directed by Architect.
5. All fire protection and sprinkler piping in un-finished areas but visible to building occupants shall be painted red unless directed otherwise by Architect. Such spaces shall include but not necessarily be limited to: parking garages and stairwells.

B. Identification of fire protection piping shall be provided as follows:

1. All interior visible piping located in accessible spaces shall be provided with pipe markers. Accessible spaces shall include, but not necessarily be limited to, the following: above accessible ceilings, inside equipment rooms and utility spaces, in attic spaces, in crawl spaces, and in chase spaces, etc. viewable via access panels.
2. All exterior visible piping shall be provided with pipe markers.
3. Peel-off, self-adhesive, sticker type labels shall not be acceptable.
4. Pipe markers shall be manufactured with rigid vinyl PVC, printed with UV resistant ink, abrasion and chemical resistant, suited for indoor or outdoor use and for a service temperature of -40 degrees F to 160 degrees F.
   a. For pipes up to 6" provide cylindrically pre-coiled markers that snap into place without the need for tape or adhesives.
   b. For pipes 6" and larger provide flat snap-around markers installed using manufacturer's heavy-duty nylon ties or stainless steel strapping.
   c. Markers shall indicate the pipe service, include flow directional arrows, and meet ANSI/ASME A13.1-2015.
5. Acceptable manufacturers:
   a. Seton Setmark Pipe Markers
   b. Brimar Industries Pipemarker System 1 Pipe Markers
   c. Brady Corporation
6. Markers shall be provided after final insulating, painting, jacketing, etc. of piping and per manufacturer's installation instructions. Strapping (applies to large diameter markers only) shall be snug but shall not compromise any insulation. All such strapping shall also be cleanly trimmed of excess material.
7. Markers shall be provided in accordance with ANSI/ASME A13.1-2015 requirements. **Specific items indicated below are not intended as a substitute for this complete standard**. Markers shall be provided:
   a. On both sides of each floor or wall penetration.
   b. On each side of each tee.
   c. On each side of each valve and/or valve group.
   d. On each side of each piece of equipment.
   e. On straight pipe runs at equally spaced intervals not to exceed 50 feet.
   f. In congested areas, on each pipe at the point it enters and exits the area.
   g. At the point of connection to each piece of equipment and automatic control valve.
   h. Where they are readily visible to personnel from the point of normal approach.
   i. With letter height and length of color field according to the size of the pipe served.
8. Color scheme of markers shall be as indicated below and otherwise in accordance with ANSI/ASME color recommendations. Legend color indicates color of legend text and flow directional arrow:

SYSTEM	LABEL COLOR	LEGEND	LEGEND COLOR
Fire Protection	Red	Fire Protection	White
	Red	Fire Sprinkler	White

3.4 REPLACEMENT

A. Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

3.5 TESTING

A. Upon completion of the installation, test the system and obtain approval of the local fire insurance rating organization having jurisdiction.

3.6 TRAINING

A. Owner's people shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown, and maintenance of the system.

B. Routine maintenance, yearly maintenance, winterization, and spring start-up shall be fully discussed and documented.

C. Names of those instructed and dates, as well as a list of information handed over to the owner, shall be included in the final report.

END OF SECTION

SECTION 21 02 01

COORDINATION DRAWINGS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.2 COORDINATION DRAWINGS

A. The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.

B. The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Contractor will be provided with the REVIT model that was used to generate the contract documents and this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT and may use any 3-D software in generating and combining the coordination model.

C. Submitting the contract drawings as coordination drawings will not be acceptable.

D. The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.

E. The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.

F. Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4” scale drawings for review.

G. The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
   a. Wall and type locations.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

e. Equipment connections and support details.
f. Exterior wall and foundation penetrations.
g. Routing of storm and sanitary sewer piping.
h. Fire-rated wall and floor penetrations.
i. Sizes and location of required concrete pads and bases.
j. Valve stem movement.
k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling mounted items.

H. Sequence of Coordination

1. Below is hierarchy of model elements and the sequencing by which the models will be coordinated.
   a. Structural and Architectural model
   b. Miscellaneous steel
   c. Perform preliminary space allocation
   d. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)
   e. Main and medium pressure ducts from the shaft out
   f. Main graded plumbing lines and vents
   g. Sprinkler mains and branches
   h. Cold and hot water mains and branches
   i. Lighting fixtures and plumbing fixtures
   j. Smaller sized ducts and flex ducts
   k. Smaller size cold water and hot water piping, flex ducts, etc.

I. The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.

J. The Contractor shall be responsible for coordination of all items that will affect the installation of the Work. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

K. By submitting shop drawings on the project, the Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all trades.

END OF SECTION

SECTION 21 05 29

HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Pipe hangers, supports, and associated appurtenances.

B. Sleeves and seals.

1.2 RELATED WORK

A. Section 21 00 00 - Fire Protection

B. Section 21 13 13 - Wet Pipe Sprinkler System

C. Section 21 13 16 - Dry Pipe Sprinkler Systems

D. Section 21 31 13 - Fire Pumps, Electric Drive

1.3 REFERENCES

A. ASME B31.1 - Power Piping.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems.

C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.4 QUALITY ASSURANCE

A. Supports for Sprinkler Piping: In conformance with NFPA 13.

B. Supports for Standpipes: In conformance with NFPA 14.

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes up through 2 Inch: Carbon steel, adjustable swivel ring type with rounded edge design, UL listed and FM approved. Anvil International Figure 69.

B. Hangers for Pipe Sizes 2-1/2 Inch and larger:

1. Carbon steel, adjustable clevis type, UL listed and FM approved. Anvil International Figure 260.
2. Carbon steel, adjustable swivel ring type, UL listed and FM approved. Anvil International Figure 69.
3. Carbon steel, UL listed straps & hangers with beveled edge design and/or plastic coating for abrasion protection of and intended for use with CPVC piping (only where such pipe material is specified). Anvil International.

C. Building structure attachments for hangers: Ductile iron, universal C-type clamps, UL listed and FM approved. Anvil International Figure 92, 93, 94.

D. Vertical Piping Supports: Carbon steel riser clamp. Anvil International Figure 40.

E. Floor Supports for pipe headers and similar horizontal runs of pipe: Steel pipe stand assembly.

1. Cylindrical pipe stanchion assembly complete with malleable iron flange or welded steel flange base plate secured to the floor by an approved method with listed anchors.
2. Each base plate shall be attached to the floor with a minimum of four (4) anchors no smaller than 1/2" diameter, per NFPA 13.
3. Provide pipe saddle support with steel U-bolt yoke and nuts to attach piping to each stand.
4. Anvil International Figure 63, Type P with Figure 259 saddle support.

F. Equivalent UL listed, FM approved hanger and support products by Eaton B-Line shall also be acceptable.

G. For installation of protective shields refer to Article 3.3.

2.2 HANGER RODS

A. Galvanized or cadmium plated carbon steel hanger rods: Threaded both ends, threaded one end, or continuous threaded. Provide rod couplings in matching finish.

2.3 INSERTS/FASTENERS

A. 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.

B. Fasteners: For wood construction and for metal purlin and metal deck applications only, the use of appropriate self-drilling fasteners (UL listed, FM approved, manufactured in USA) provided in accordance with manufacturer’s recommendations shall be acceptable. ITW Buildex “Sammys” products or pre-approved equal.

2.4 SLEEVES

A. All pipe penetrations through walls, floors, floor-ceiling assemblies, etc. shall be sleeved to ensure no direct contact between the pipe and that which it passes through. All installations shall be provided consistent with the fire and smoke safeguards required by the building code per the fire-resistance rating as indicated on the architectural drawings and shall be provided consistent with the assemblies/methods indicated on the architectural drawings.

B. Unless required otherwise (the most stringent requirement shall govern), sleeves for pipes:

1. Through nonfire-resistance-rated floors shall be formed with 18 gage galvanized steel, tack welded to form a uniform sleeve.
2. Through nonfire-resistance-rated walls, through grade beams and foundation walls, and through potentially wet floors shall be formed with schedule 40 steel pipe, galvanized.
3. Through assemblies including but not limited to fire-resistance-rated walls-barriers-partitions, smoke barriers-partitions, etc. shall be schedule 40 steel pipe securely fastened to the rated assembly. All annular spaces shall be firestopped with an approved penetration firestop system (UL listed) compatible with the pipe material and installed per the manufacturer's recommendations.

C. Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.

D. Caulk: Paintable 25-year acrylic sealant.

E. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.5 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

2.6 FINISH

A. Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping with maximum distance between hangers and minimum hanger rod diameters as follows:

Pipe Size	Max. Hanger Spacing	Min. Rod Diameter
(Steel Pipe)		
1 to 1-1/4 inch	10'-0"	3/8"
1-1/2 to 3 inch	12'-0"	3/8"
4 to 6 inch	12'-0"	1/2"
8 to 10 inch	12'-0"	5/8"
12 to 14 inch	12'-0"	3/4"
(CPVC Pipe, only where specified)		
3/4 to 1 inch	4'-0"	3/8"
1-1/4 to 1-1/2 inch	4'-0"	3/8"
2 to 3 inch	6'-0"	3/8"

B. Where a listed CPVC pipe manufacturer’s maximum hanger spacing is more stringent than the spacing above, it shall be followed.

C. Spacing of hangers for unbroken lengths of CPVC pipe shall be permitted to be increased to a maximum of 5’-6” for 3/4" piping and 6’-0” for 1” through 1-1/2” piping.

D. Ensure to adequately secure sprinkler piping to restrict the movement of piping upon sprinkler operation. Where listed CPVC pipe is specified, supports must be provided as required in accordance with the pipe manufacturer’s recommendations.

E. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

F. Place a hanger within 12 inches of each horizontal elbow and at the vertical to horizontal transition.

G. Use hangers with 1-1/2 inch minimum vertical adjustment.

H. Ensure that hanger rods are only loaded axially (along the rod). Provide additional hangers or restraints as necessary to minimize non-axial loads

I. Threaded sections of rod shall not be formed or bent, neither prior to nor as a result of installation.

J. Support vertical piping at every floor. Distances between supports for risers shall not exceed 25 feet.

K. In multi-story buildings (in addition to at every floor) riser supports shall be provided at the lowest level, above and below offsets, and at the top of the riser.

L. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

M. Support riser piping independently of connected horizontal piping.

N. Install hangers with a nut at the base and above the hanger; tighten upper nut to hanger after final installation adjustments.

O. Where piping is subject to seismic activity, ensure to provide protection measures in accordance with NFPA 13 requirements.

3.3 INSULATED PIPING

A. Comply with the following installation requirements.

B. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

C. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

D. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

Nominal Pipe Size	Length	Thickness
1/4 through 3-1/2 inch	12 inch	0.048 inch
4 inch	12 inch	0.060 inch
5 through 6 inch	18 inch	0.060 inch
8 through 14 inch	24 inch	0.075 inch
16 through 24 inch	24 inch	0.105 inch

E. Piping 2” and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.

F. Insert material shall be at least as long as the protective shield.

G. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

3.5 SEALS

A. Provide flexible watertight sealant where piping penetrates waterproofed walls, floors, and roofs.

B. Where dry sprinklers are connected to wet pipe sprinkler systems protecting areas subject to freezing temperatures (such as, but not necessarily limited to, insulated freezer structures) ensure that the clearance space around the sprinkler barrel is completely sealed in accordance with the manufacturer's recommendations.

3.6 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermafiber and 3M caulking and provide floor plate.

C. Where piping penetrates a floor, ceiling, or wall, close off space between pipe and adjacent work with UL listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D. Fire protection sleeves may be flush with floor of stairways.

END OF SECTION

SECTION 21 13 16

DRY PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

C. Refer to Section 21 00 00 for integral requirements.

1.2 SCOPE

A. Scope of the work shall include the furnishing and complete installation of the fire protection piping, valves, sprinkler heads, and equipment covered by this Section, with all appurtenances, ready for owner's use.

B. The scope of work shall include the painting and pipe marking of fire sprinkler system piping as described in Section 21 00 00.

C. Dry pipe system(s) shall be installed in entire facility and any outdoor areas under the roof structure (or permanently attached overhangs) required to be sprinklered; all such areas shall be completely protected in this manner. The dry pipe valve(s) and supply piping shall be located in an area protected against freezing and mechanical injury.

D. The scope of work shall include providing a complete and properly sized system:

1. For continuously generating sufficiently dry nitrogen gas of no less than 98% purity.
2. To fill and maintain the requisite volume and pressure of this supervisory gas supply in the sprinkler system at all times.
3. With nitrogen generation based on membrane gas separation technology.
4. Complete with oxygen removal vent(s) located in the sprinkler riser room to facilitate removal of oxygen from the sprinkler system piping. Gas sampling shall also be located in this same location.

1.3 RELATED WORK

A. Section 21 00 00 - Fire Protection

B. Section 21 02 01 - Coordination Drawings

C. Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment

D. Section 21 30 10 - Pre-Packaged Fire Pump & External Enclosure

1.4 REFERENCES

A. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

B. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe.

C. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use.

D. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

E. NFPA 13 - Standard for the Installation of Sprinkler Systems.

F. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

G. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

H. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and **country of origin**.

D. Domestic Manufacture: All valves, pipe, fittings, sprinkler heads, and equipment shall be by a domestic manufacturer.

E. Welding Procedures and Performance:

1. Meet or exceed the requirements of AWS B2.1/B2.1M “Welding and Brazing Qualifications”; as well as any local AHJ requirements.
2. Maintain and be able to produce complete certified records, including, but not necessarily limited to, the following: Welding Procedure Specifications (WPS’s), Procedure Qualification Records (PQR’s), and welder qualification records.

1.6 SUBMITTALS

A. Submit shop drawings in accordance with Section 22 02 00 and as described below.

B. Submit product data with manufacturer’s catalog information, product certifications, and **country of origin** identified. Indicate valve data and ratings. Product data to be submitted shall include, but not necessarily be limited to, the following:

1. Pipe material
2. Pipe fittings and couplings
3. Sprinkler heads and guards
4. Valves, oxygen removal vents, and backflow preventers
5. Nitrogen generator and appurtenances
6. Waterflow, supervisory and alarm devices
7. Fire-stopping sealant and pipe marker products
8. Spare sprinkler head box, signage, and other accessories
9. Include a schedule of wall sleeves to be provided

C. Product data for hangers and supports *may* be submitted under this section, although these items are specified under 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment

D. Submit shop drawings of entire sprinkler system with all head locations and including accompanying hydraulic calculations to the Architect/Engineer for review. **A current and fully documented fire hydrant flow test must be included.**

E. Submit complete product data for 21 30 00 - Fire Pumps **concurrently** with the submittal for this Section, for all systems served by such equipment.

F. Provide Architect with six complete sets of final approved shop drawings before starting the installation. Include details of the sprinkler system showing sections, light fixtures, ducts, and a plan indicating fire department connections, location of all exposed structures within twenty feet of this structure, and other equipment to be used. Drawings shall bear the stamp of review of the local fire insurance rating organization having jurisdiction.

G. Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground work.

H. Where a project is required to comply with FM Global requirements, ensure to submit a set of drawings, hydraulic calculations, and other required documentation to a designated representative of FM Global for review and acceptance prior to the start of any system installation.

1.7 REGULATORY REQUIREMENTS

A. Work in accordance with :

1. NFPA 13
2. NFPA 14
3. NFPA 24
4. NFPA 25
5. Requirements of the local Authority Having Jurisdiction (AHJ)
6. FM Global Datasheet 2-0.
7. FM Global Datasheet 2-1.

B. Product in accordance with:

1. UL listed.
2. FM (Factory Mutual) approved.
3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.8 CERTIFICATE OF TESTING

A. Furnish Owner with test certificate certifying the system approved by:

1. Fire Marshal
2. Insurance Services Officials

PART 2 - PRODUCTS

2.1 GENERAL

A. Work included:

1. Design, coordination, furnishing, and installation of inside and outside piping, valves, sprinkler heads, hangers, supports, sleeves, and nitrogen generator.
2. The sprinkler system is a dry pipe automatic system and shall be designed to provide coverage for the area(s) indicated on the Drawings.
   a. The Contract Drawings indicate the general system extent and location for the dry pipe valve and riser.
   b. The Contract Drawings identify rooms and spaces, which may aid in the determination of the various occupancy hazard classifications.
   c. Sprinkler heads are not shown.
3. The Drawings provide a preliminary layout with locations of water service entry/water supply, control valves, riser assembly/zone valves, and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.
4. Prior to bid the fire sprinkler contractor shall determine if more than one dry system is required to protect the area(s) indicated. Failure to do so shall not add cost to the contact or to the Owner.
5. Coordinate work and installation with electrical and fire alarm contractors accordingly. Ensure that power is provided at required locations. Ensure that system is interfaced with the building fire and smoke alarm systems. This shall include, but not necessarily be limited to:
   a. Flow and tamper switches - including any remote locations such as backflow preventer vaults, water supply post indicating valves, etc.
   b. Waterflow signals ensure the immediate shut down of associated HVLS fans per NFPA 13, 11.1.7.
   c. Monitoring of the nitrogen generator.

B. Requirements:

1. Materials and installation to meet or exceed the requirements of NFPA 13, prevailing edition and the local Authority Having Jurisdiction (AHJ).
2. All components of the system shall be UL listed for the intended service.
3. Provide components with minimum pressure ratings as suited for system working pressure(s).

2.2 VALVES AND SUPERVISORY GAS

A. General valve requirements:

1. Valves shall be rated for no less than 175 psi.
2. All valves controlling connections to water supplies and to supply pipes to sprinklers shall be listed indicating valves.
3. Drain and test valves shall be approved.
4. All control, drain, venting, and test connection valves shall be provided with permanently marked weatherproof metal identification signs.
5. Provide as indicated on the Drawings and configured in accordance with the requirements of the local Authority Having Jurisdiction.

B. Dry Pipe Valves

1. Dry pipe valve assembly shall be UL listed, FM approved and provided complete with listed alarm attachments.
   a. Approved pressure gauges shall be provided on both the water side and gas side of the dry pipe valve.
   b. Approved pressure gauge shall be provided on the gas supply to the dry pipe valve.
   c. Valve body shall include a removable cover for valve clapper access.
   d. A listed accelerator type quick-opening device complete with approved pressure gauge shall be provided as necessary.
   e. Acceptable dry pipe valve manufacturers:
      1) Victaulic
      2) Reliable
      3) Tyco-Grinnell
   f. Provide a listed and dedicated automatic air maintenance device to control supervisory gas flow to each dry pipe system. Unit shall be pre-piped, valved, and complete with fittings and actuator as appropriate for the system. Acceptable device manufacturers:
      1) Victaulic Series 757
      2) Reliable Model A
      3) Tyco Model AMD-1
2. Local waterflow alarm devices shall be a listed water-motor operated device or an electrified bell type for outdoor installation. Additionally, provide an electrified bell for indoor installation. System Sensor, Potter, or Reliable.
3. Provide connectivity to the building fire alarm system.

C. Nitrogen Supervisory Gas Generator

1. FM Approved, UL 508A Listed industrial control cabinet/panel.
2. Air bypass and leak monitoring alarm signals included. Provide connectivity to the building fire alarm system.
3. Capable of keeping up with system leak rate in accordance with both NFPA 13 and NFPA 25 requirements.
4. Fully tested and assembled, turn key package for wall mounted or skid-mounted arrangement per system size. Provide stand alone with separate adjacent air compressor as required for sprinkler system size.

5. Complete with integrated oil-less air compressor and bypass valve, or with separate oil lubricated air compressor as required per system size.
6. Configured for 120 VAC and/or higher voltage if required for a three-phase compressor due to sprinkler system size. Coordinate final power requirements in field with electrical contractor.
7. Membrane separation technology based, 98% high purity nitrogen generation.
8. Sized with a capacity capable of restoring normal supervisory pressure in the system within 30 minutes (or within 30 minutes for the single largest system where the nitrogen generator serves more than one dry system).
9. Acceptable manufacturers: ECS (Engineered Corrosion Solutions) or pre-approved equal.
10. Paired with float valve based oxygen removal vent assembly with pressure regulating device by the same manufacturer. One for each dry pipe system. ECS model PAV-D.
11. For multi-zone sprinkler systems with differing supervisory gas pressure needs, provide a nitrogen interface controller if and as necessary.

D. Control Valves (Gate)

1. Control valves shall be UL listed, FM approved bronze trimmed resilient wedge gate type.
2. Provide bronze bodied, rising stem, inside screw type for sizes 2" and smaller. Provide ductile iron bodied, rising stem, outside screw and yoke type for sizes 2-1/2" and larger.
3. Acceptable manufacturers:
   a. Mueller Company
   b. Kennedy Valve
   c. Victaulic
   d. Nibco

E. Control Valves (Butterfly)

1. Control valves shall be UL listed, FM approved ductile iron bodied, gear operated with flag, butterfly type.
2. Acceptable manufacturers:
   a. Reliable
   b. Kennedy Valve
   c. Tyco-Grinnell
   d. Victaulic
   e. Nibco

F. Check Valves

1. Check valves shall be UL listed, FM approved ductile or cast iron bodied, bronze fitted, non-slam type, suited for horizontal or vertical installation.
2. Acceptable manufacturers:
   a. Mueller Company
   b. Kennedy Valve
   c. Victaulic
   d. Nibco
   e. Tyco-Grinnell

G. Test and Drain Valve Assemblies shall be UL listed, FM approved bronze bodied ball valve type complete with tamper resistant test orifice and sight glasses. AGF Manufacturing, Inc.

H. Auxiliary drains shall be provided to ensure that all sections of the system can be drained of water. Provide at all low points and similar locations, complete with water detector alarm component to notify personnel of excess water. Wire to fire alarm panel or BMS to remote notification. Pre-manufactured black steel pipe nipple with quarter turn ball valves. AGF Manufacturing, Inc. Model 5300ALBV.

I. Backflow Preventers: Provide as indicated on the Drawings and in accordance with the requirements of the water supplier and public health Authority Having Jurisdiction. All such devices shall be listed for fire protection service.

2.3 PIPE AND FITTINGS

A. Underground service entry shall be: UL listed, FM approved, NFPA 24 compliant, type 304 stainless steel, pre-fabricated in-building riser. Acceptable manufacturers:

1. Ames Fire & Waterworks
2. Zurn Wilkins

B. All sprinkler system piping above grade shall be (refer to 21 00 00 for **standpipe** system piping):

1. ASTM A135/A135M / ASTM A53/A53M schedule 40 black steel pipe with roll-grooved ends, joined with mechanical couplings and with manufactured carbon steel grooved fittings with matching mechanical couplings for pipe 2-1/2" and larger. Fittings shall be fully metallically formed type with an independent gasket and coupling at each pipe connection. All coupling assembly points shall have bolts and nuts.
2. ASTM A135/A135M / ASTM A795/A795M schedule 40 black steel threaded pipe and cast iron or malleable iron fittings for pipe 2" and smaller.
3. Welding shall be acceptable only for providing ASTM A53/A53M shop welded, branch outlet fittings, UL Listed and FM Approved for use in fire sprinkler systems, in accordance with NFPA 13 and local AHJ requirements.
   a. Merit Manufacturing Corporation or pre-approved equal.
   b. In no case shall butt-welding of pipe ends be allowed.

C. Acceptable Manufacturers:

1. Wheatland Tube Company
2. Bull Moose Tube Company
3. Tex-Tube
4. Allied Tube

D. Acceptable mechanical coupling manufacturers (all grooved couplings and gaskets shall be listed for dry service):

1. Victaulic
2. Tyco-Grinnell

3. Anvil Gruvlok

E. **Regardless of manufacturer, the use of pipe hole-cut, gasketed bolt-on branch outlets shall not be permitted. This prohibition includes, but is not necessarily limited to, the following: clamp-T, mechanical-T, outlet-T, strap-T, and U-bolt-T outlet connectors.**

F. In all locations subject to corrosive conditions, ensure to provide a suitable epoxy (spray) coating to all exposed surfaces of pipe and fittings. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens. All job-applied protective coatings shall be provided as approved and only after verification that the proper piping has been installed, per the markings along the length of the pipe.

2.4 SPRINKLER HEADS

A. All sprinkler heads shall be either upright or listed dry sprinkler heads.

B. Finished Ceiling Type: Listed dry pendent concealed type with white cover plate or in color to match ceiling finish.

C. Exposed Area Type: Standard upright type with brass finish.

D. Sidewall Type: Chrome plated finish with matching escutcheon.

E. Temperature rating on fusible links to suit specific hazard area with minimum margin or safety of 50 degrees F.

F. Sprinkler heads of the “O”-ring seal type are not acceptable.

G. In all locations subject to corrosive conditions provide heads entirely constructed of stainless steel or heads with polyester coated finish and dipped in wax. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens.

H. In all locations subject to occupant abuse or vandalism provide institutional type sprinkler heads with tamper-resistant construction and suitable “break-away” weight test documentation from the manufacturer. Such locations shall include, but not necessarily be limited to, the following: patient areas of institutional mental health occupancies, prisoner areas (cells, etc.) of correctional facilities – jails, prisons, juvenile detention facilities.

I. Acceptable manufacturers:

1. Tyco-Grinnell
2. Viking
3. Victaulic
4. Reliable
5. Globe Fire Sprinkler Corporation

2.5 FIRE DEPARTMENT CONNECTIONS

A. Refer to Section 21 00 00 for all such requirements.

PART 3 - EXECUTION

3.1 GENERAL

A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items as required by NFPA 13 and installed as per manufacturer's recommendations.

3.2 DESIGN

A. Design spacing of sprinkler heads and selection sizes shall conform to the requirement of NFPA 13 for the occupancy hazard.

B. Uniform discharge density design shall be based on hydraulic calculations utilizing the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.

C. Friction losses in pipe will be based on a value of "C" =100 in the Hazen-Williams formula for steel pipe.

D. Design and install the system so that no part will interfere with doors, windows, heating, plumbing, or electrical equipment. Do not locate sprinkler heads within 6 inches of lighting fixtures, HVAC diffusers and other obstructions. Sprinkler piping cannot penetrate ductwork, structural members, or lighting fixtures.

E. The Contractor shall conform to NFPA 13, prevailing edition. Special attention shall be given to the Chapters on Plans and Calculations and on Systems Acceptance. It shall be the Licensed Fire Sprinkler Contractor’s responsibility to determine if any deficiencies exist, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

F. Reference the latest architectural reflected ceiling plans. Extend branch lines accordingly to provide sprinklers both above and below “cloud” ceilings, where present and as required.

G. Ensure to provide sprinklers under fixed obstructions (such as ductwork) over 48 inches wide.

3.3 INSTALLATION - GENERAL

A. Install all items in accordance with applicable codes.

B. Install piping so that mains and branches are not located directly underneath HVAC equipment or other items needing access.

C. Do not install risers or mains in MDF/IDF/Data closets or electrical rooms. Where sprinkler protection is provided, only the associated branch lines and sprinkler heads shall be allowed in such spaces.

D. Furnish additional heads which may be required for coordinated ceiling patterns without added cost, even though number of heads may exceed minimum code requirements.

E. All sprinkler heads shall be located as near the center of ceiling tiles as is practical (±1/2”). Location shall present a uniform pattern with all heads aligned when completely installed.

F. Run piping concealed above furred ceilings and in joist space to minimize obstructions. Expose only heads. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.

G. Provide wire guards on all non-concealed pendent and upright sprinklers heads subject to damage, including, but not necessarily limited to, the following locations: mechanical rooms, gymnasiums, athletic areas, wood and metal shops.

H. Locate outside alarms on wall of building adjacent to sprinkler riser room.

I. Provide on wall near the sprinkler valve(s): a clearly labeled and suitably sized cabinet containing (a minimum of 5% but no less than four) spare sprinkler heads of each type and a wrench suitable for each head type.

J. Provide one case of spare escutcheons for each type of sprinkler head.

K. Provide 1 inch diameter nipple and 1 inch x 1/2 inch reducing fitting for each upright head.

L. Nitrogen filling (more than one cycle may be required for complete oxygen removal) and nitrogen generator system installation and start-up shall be in strict accordance with the manufacturer's published recommendations.

3.4 INSTALLATION - DRAINAGE

A. All sprinkler pipe and fittings shall be installed so that the system can be drained.

B. Unless not practicable, all piping shall be arranged to drain to the main drain valve for each sprinkler system. Make provisions accordingly for any trapped piping and provide auxiliary drains as necessary, complete with signage, and in accordance with NFPA 13 requirements.

C. Ensure to provide the required pitch to drain per NFPA 13 requirements.

D. Unless noted otherwise on the Drawings or in conflict with Owner requirements, all drains shall discharge to the outdoors at locations free from the possibility of causing water damage. Each such drain shall be provided with a chrome wall escutcheon and 45 degree galvanized ell turned down.

3.5 SYSTEM IDENTIFICATION

A. Provide a printed sheet giving brief instructions relative to all necessary aspects of sprinkler controls and emergency procedures next to sprinkler riser mains. Instruction sheet shall be laminated or protected by a transparent plastic cover.

B. Provide laminated zone map(s) at the riser location(s) clearly indicating the geographical area protected by each zone valve/floor control assembly. Floor plan shall include the locations of all valves (marked and labeled).

C. Provide an additional laminated map as described above at the fire alarm control panel.

D. All hydraulic calculation plates must be engraved.

E. Each system valve (indoor and outdoor) must be permanently labeled with the system information.

F. Signage:

1. Each riser room door must have a 2'-0" x 3'-0" sign provided on the outside with the wording "SPRINKLER RISER ROOM."
2. Each fire department connection shall have a sign with the street address on it.
3. Signage provided shall comply with NFPA and local AHJ requirements.

3.6 PAINTING AND PIPE IDENTIFICATION

A. Refer to Section 21 00 00 for all such requirements.

3.7 REPLACEMENT

A. Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

3.8 TESTING

A. Prior to testing, the entire sprinkler system shall be thoroughly flushed clean.

B. Upon completion of the installation and flushing, test the system and obtain approval of the local fire insurance rating organization having jurisdiction. Particular attention is called to the acceptance requirements of NFPA 13 .

C. Testing and acceptance must be provided for underground and aboveground piping per NFPA 13 and local AHJ requirements. Documentation of such shall be provided to the Owner.

D. In addition to the standard hydrostatic test, a supervisory gas leakage test at 40 psi shall be conducted for 24 hours in accordance with NFPA 13 requirements. Any leakage that results in a loss of pressure in excess of 1.5 psi for the 24 hours shall be corrected.

E. After successful acceptance testing and approval all water shall be drained and all residual water shall be purged from the system prior to filling the dry piping with supervisory gas.

3.9 TRAINING

A. The Owner's maintenance staff shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown.

B. Routine maintenance, yearly maintenance including nitrogen generator filter replacement, and any seasonal requirements or considerations shall be fully discussed and documented.

C. Names of those instructed and dates, as well as a list of information provided to the Owner shall be included in the final report.

END OF SECTION

SECTION 21 31 13

FIRE PUMPS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

C. Refer to Section 21 00 00 for integral requirements.

1.2 SCOPE

A. Scope of the work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for the Owner's use.

B. The scope of work shall include the following:

1. Fire pump, electric motor, and base plate with foundation.
2. Fire pump controller, jockey pump, jockey pump controller.
3. Suitable flanges, required adapters/reducers, valves, gauges, fire pump test header with hose valves, flow meter testing device, and all associated piping, concrete pads/foundations, and appurtenances for a compliant and functioning installation.
4. Coordinate work and installation with electrical and fire alarm contractors accordingly. Ensure that power is provided at required locations. Ensure that system is interfaced with the building fire and smoke alarm systems. This shall include all flow and tamper switches.

1.3 RELATED WORK

A. Section 21 00 00 - Fire Protection

B. Section 21 02 01 - Coordination Drawings

C. Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment

D. Section 21 13 13 - Wet Pipe Sprinkler System

E. Section 21 13 16 - Dry Pipe Sprinkler Systems

F. Section 26 05 19 - Wire, Cable and Related Materials

1.4 REFERENCES

A. FM (AG) - FM Approval Guide.

B. NEMA MG 1 - Motors and Generators.

C. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection.

D. NFPA 22 - Standard for Water Tanks for Private Fire Protection.

E. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

F. NFPA 70 - National Electrical Code.

G. UL (DIR) - Online Certifications Directory.

H. UL 448 - Centrifugal Stationary Pumps for Fire-Protection Service.

I. UL 1478 - Fire Pump Relief Valves.

J. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

1.5 QUALITY ASSURANCE

A. Fire pump, controllers, valves, and testing devices shall be listed for fire pump/fire protection service.

B. Provide fire pump system in accordance with NFPA 20 and Authorities Having Jurisdiction. Adhere to related requirements of NFPA 22 where a fire protection water tank is provided.

C. Ensure products and installation of specified products are in conformance with applicable recommendations and requirements of the following organizations:

1. National Fire Protection Association (NFPA)
2. American Society of Mechanical Engineers (ASME).
3. National Electrical Manufacturers Association (NEMA).
4. UL, LLC.

1.6 SUBMITTALS

A. Submit shop drawings in accordance with 22 02 00 and as described below.

B. Submit complete product data for fire pump and associated appurtenances including, but not necessarily limited to, the following:

1. A summary sheet listing all submitted items and describing key information for all items, including warranty statement(s).
2. Manufacturer's product data for fire pump:
   a. Type, approvals, materials of construction, exploded view, orientation, flange information, and all included features.
   b. Pump curve showing and summarizing performance characteristics including pump horsepower, operating point, secondary operating point, and maximum shutoff. Suction source and supply pressure shall also be indicated.

c. Dimensional drawing showing pump series, model, size, rotation, motor data, suction and discharge sizes, weights, overall and critical dimensions.
d. Product data and selection information for UL 448 listed flexible coupling (for separately coupled pumps).

3. Manufacturer's product data for jockey pump:
a. Type, application, materials of construction, exploded view, orientation, and all included features.
b. Pump curve showing and summarizing performance characteristics including pump horsepower and operating point.
c. Dimensional drawing showing pump series, model, stages, rotation, motor data, suction and discharge sizes, weight, overall and critical dimensions.

4. Manufacturer's dimensioned technical and performance data and sizes for valves, gauges, increasers, decreasers, and appurtenances.

5. Manufacturer's installation instructions and dimensioned technical and performance data and sizes for flow meter testing devices.

6. Manufacturer's dimensioned technical and performance data, listing information, and wiring diagrams for motors.

7. Manufacturer's product data for controllers:
a. Starting type, full electrical characteristics, approvals, and all included features.
b. Dimensional drawing showing overall and critical dimensions, weight, enclosure type, connection points, and wiring diagrams.
c. Ensure that the lugs on the breaker of the fire pump controller are coordinated with the size of the incoming electrical conductors.

8. Where a project is required to comply with FM Global requirements, ensure to submit a set of all required documentation to a designated representative of FM Global for review and acceptance prior to the start of any system installation.

1.7 REGULATORY REQUIREMENTS

A. Work in accordance with:

1. NFPA 20
2. NFPA 25
3. Requirements of the local Authority Having Jurisdiction (AHJ).

B. Products in accordance with:

1. UL (DIR) listed.
2. FM (AG) approved.
3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.8 CERTIFICATE OF TESTING

A. Furnish the owner with test certificate certifying the installation approved by:

1. Fire Marshal
2. Insurance Services Officials

1.9 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Operation Data: Include manufacturers' instructions, start-up data, and trouble-shooting check lists for pumps, drivers, and controllers.

C. Maintenance Data: Include manufacturers' literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

D. Field Reports: Include field acceptance test documenting proper performance in accordance with the provisions of NFPA 20.

1.10 MAINTENANCE SERVICE

A. Furnish service and maintenance of fire pump, driver, and controller for one year from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide one extra set of water ring seals, packing gland, and packing for each pump type and model supplied.

PART 2 - PRODUCTS

2.1 FIRE PUMP

A. Acceptable Manufacturers:

1. AC Fire Pump
2. Armstrong
3. Aurora
4. Fairbanks
5. Patterson
6. Peerless

B. UL 448, single stage, centrifugal bronze fitted pump, UL (DIR) / FM (AG) listed for fire protection service. As scheduled on Drawings and suited for the rating of the fire protection system, but in no case with less than a maximum working pressure of 175 psig. Complete with manufacturer's nameplate.

C. Fire pumps shall be designed to deliver the scheduled capacities with the suction condition as indicated. Pumps shall furnish a flow of not less than 150% of rated capacity at a pressure not less than 65% of rated head. The total shutoff head shall not exceed 140% of the total rated head.

D. Vertical in-line pumps:

1. Close coupled type, for in-line mounting with support.
2. Casing: Cast or ductile iron construction, with suction and discharge gauge ports, vent and drain tappings, bronze casing wear ring(s), flanged suction and discharge.
3. Impeller: Cast bronze, fully enclosed, keyed directly to motor shaft.
4. Shaft: Vertical solid alloy steel with bronze shaft sleeve and bronze packing gland.
5. Seal: Packed type stuffing box with multiple rings of graphic impregnated yarn packing and lantern ring in accordance with NFPA 20.

E. Horizontal base-mounted pumps:

1. Separately coupled type, for pump and driver common, formed steel drip-rim base frame mounting.
2. Casing: Cast or ductile iron construction, horizontally split, with suction and discharge gauge ports, relief valve tap, bronze casing wear ring(s), flanged suction and discharge.
3. Impeller: Cast bronze, fully enclosed, balanced, with stainless steel impeller key.
4. Shaft: Horizontal solid alloy steel with bronze shaft sleeve and bronze packing glands.
5. Seal: Packed type stuffing box with multiple rings of graphite impregnated yarn packing and lantern ring in accordance with NFPA 20.
6. Bearings: Long life steel, regreasable ball bearings, replaceable without opening pump casing. Complete with water slingers.
7. Drive: Fail safe UL 448 flexible coupling complete with coupling guard.

2.2 FIRE PUMP APPURTENANCES

A. Eccentric suction reducer (as necessary) and OS&Y gate valve on suction side of pump.

B. Concentric increaser (as necessary) and check valve in pump discharge with OS&Y gate or butterfly valve on system side of check valve.

C. Fire pump/break tank full-sized bypass fitted with OS&Y gate or butterfly valves and approved double check valve type backflow preventer, listed check valve, etc. as appropriate.

1. The backflow prevention device provided shall meet both the project requirements and the requirements of the local water authority.
2. The bypass pathway shall be normally open and all valves supervised.

D. Listed, venturi type, water flow metering device with flanged or grooved connections and associated valves for pump testing.

1. Acceptable manufacturers:
   a. Gerand Engineering Company
   b. Global Vision, Inc.
   c. Victaulic
2. **Preso brand is specifically prohibited.**

E. Suction pressure gauge, 4-1/2 inch diameter liquid-filled dial type with snubber, valve cock and lever handle. Where the minimum pump suction pressure is below 20 psi under any flow condition, the gauge shall be a compound pressure and vacuum gauge.

F. Discharge pressure gauge connected to or near the discharge casting, 4-1/2 inch diameter liquid-filled dial type with snubber, valve cock and lever handle.

G. UL 1478 listed 3/4 inch casing relief valve, discharged to drain. Bronze body, stainless steel trimmed. Cla-Val or pre-approved equal.

H. UL (DIR) / FM (AG) float operated minimum 1/2 inch automatic air release valve for other than vertical inline pumps. Cla-Val or pre-approved equal.

I. Listed wall mounted test header with 2-1/2 inch hose gate valves with caps and chains. Quantity of hose valves and pipe size of test header supply shall be in accordance with the requirements of NFPA 20, Chapter 4. Cast brass bodied, with polished chrome plated finish unless noted otherwise. Potter Roemer 5860 series or equivalent offering by Cla-Val.

J. Tamper switches on gate and butterfly valves.

2.3 ELECTRIC MOTOR DRIVE

A. Motor: Squirrel cage induction type; in open drip proof NEMA MG 1 enclosure, RPM as scheduled. Refer to Section 26 29 13.

B. Fire Pump Controller: UL (DIR) / FM (AG) factory assembled, wired and tested unit of the combined manual and automatic type and conforming to the requirements of NFPA 20 and NFPA 70. Housed in an **ANSI/NEMA 4enclosure**. Acceptable manufacturers:

1. Tornatech
2. Firetrol
3. Metron
4. Master

C. Controller Starting Method: Provide soft start, reduced voltage starting.

D. Controller Features shall include:

1. Disconnect Switch: Externally operable, quick break type.
2. Circuit Breaker: Trips in each phase calibrated at least to 300% of the motor full-load current, 100,000 amperes interrupting capacity.

3. Integral voltage surge protection device.
4. Motor Starter: Energized automatically through pressure switch or manually by externally operable handle.
5. Pressure Switch: Set to cut in at pressure required to maintain 100 psig at top of building standpipe riser or as required for the fire sprinkler system.
6. An automatic transfer switch (ATS) for all instances where the fire pump is on emergency power.
7. Running Period Timer: Keeps motor in operation when started automatically, for a minimum of seven minutes.
8. Pilot Lamp: Indicates circuit breaker closed and power available.
9. Amp-meter test link and voltmeter test studs.
10. Alarm Relay: Energizes alarm to indicate circuit breaker open or power failure.
11. Remote start switch relay.
12. Manual Selector Station: On enclosure marked "Automatic" and "Non-Automatic."
13. Controller shall be rated for service entrance and shall include a neutral bar.

2.4 PRESSURE MAINTENANCE (JOCKEY) PUMP

A. Acceptable manufacturers:

1. Armstrong
2. Aurora
3. Fairbanks
4. Goulds
5. Grundfos
6. Patterson

B. Approved, electrically operated, vertical multi-stage type with totally enclosed fan cooled (TEFC) motor.

C. Each pump shall have all hydraulic components of stainless steel construction.

D. The jockey pump shall be provided with a relief valve on the discharge if and as necessary and sized to prevent over-pressurizing and damage to the fire protection system. Valve shall be provided complete with piping to drain.

E. Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

F. The jockey pump control panel shall be an **ANSI/NEMA 4 enclosure**, factory assembled, wired, and tested and shall be finished with a baked enamel coating. Panel shall include at least the following equipment:

1. One non-fused disconnect switch mounted on panel door.
2. One combination magnetic motor controller.
3. One hand-off-automatic selector switch mounted on panel door.
4. 120 volt control power transformer and fused disconnect switch as required to operate switches and controls in the panel.

G. **The jockey pump controller shall be by the same manufacturer as the fire pump controller.** Acceptable manufacturers:

1. Tornatech
2. Firetrol
3. Metron
4. Master

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pumps and equipment in accordance with manufacturer's instructions and to UL/FM, NFPA 20 and NFPA 70 requirements.

B. If a fire protection water tank is to be provided, coordinate positioning and installation of pumps, piping, controllers, and appurtenances with the adjacent tank.

C. Ensure to provide sufficient straight run of piping and position fittings in accordance with NFPA 20 requirements to prevent unbalanced flow of water into the fire pump impeller.

D. Ensure to provide a suitably sized concrete housekeeping pad/foundation for the fire pump and jockey pump, consistent with NFPA 20 requirements.

E. Pump room floor shall be pitched and at least one (1) floor drain provided for adequate drainage of escaping water away from critical equipment, such as the fire pump, driver, controller, etc.

F. Drains for bases and seals shall be piped to discharge to floor drain(s).

G. Ensure access space around pumps for service, providing no less than the minimum recommended by the manufacturer.

H. Ensure that piping adjacent to pump is supported such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.

I. Provide for connection to electrical service. Refer to Section 26 05 19.

J. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.

3.2 FIELD QUALITY CONTROL

A. Ensure to flush and hydrostatic test piping per the requirements of NFPA 20. The installing contractor shall furnish a certificate for flushing and hydrostatic test prior to the start of the fire pump field acceptance test.

B. Upon completion of the entire fire pump installation, an acceptance test shall be conducted in accordance with the provisions of NFPA 20. Make appropriate arrangements for this test to be witnessed by the Fire Marshal, Owner's insurance underwriter and Architect/Engineer.

C. A factory certified technician shall be made available on the job site to check installation, field acceptance testing, start-up, and to instruct operating personnel.

END OF SECTION

SECTION 21 41 00

STORAGE TANKS (WELDED STEEL) FOR FIRE-SUPPRESSION WATER

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. The scope and work shall include, but not necessarily be limited to, the following:

1. Above ground, vertical, cylindrical single wall welded steel tank for fire protection water storage.
2. Fill valves.
3. Water level sensing and alarm systems.
4. Associated piping and wiring.
5. Coordinate with civil/structural engineer to ensure a concrete support pad with foundation as required is provided to support the tank and associated appurtenances.

1.3 RELATED WORK

A. Section 21 00 00 - Fire Protection

B. Section 21 02 01 - Coordination Drawings

C. Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment

D. Section 21 13 13 - Wet Pipe Sprinkler System

E. Section 21 13 16 - Dry Pipe Sprinkler System

F. Section 21 30 10 - Pre-Packaged Fire Pump & External Enclosure

G. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

H. Section 26 05 19 - Wire, Cable and Related Materials

1.4 REFERENCES

A. AISC - American Institute of Steel Construction: Manual of Steel Construction

B. 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.

C. AWWA D100 - Welded Carbon Steel Tanks for Water Storage.

D. AWWA D102 - Coating Steel Water-Storage Tanks.

E. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection.

F. NFPA 22 - Standard for Water Tanks for Private Fire Protection.

G. NSF 61 - Drinking Water System Components - Health Effects.

H. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids.

I. ASTM A36/A36M - Standard Specification for Carbon Structural Steel

J. AWS - American Welding Society: Structural Welding Code - Steel

K. NFPA 13 - Standard for the Installation of Sprinkler Systems

L. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems

M. NFPA 70 - National Electrical Code

N. OSHA - U.S. Department of Labor, Occupational Safety and Health Administration

O. PEI - Petroleum Equipment Institute: RP200, Recommended Practices for Installation of Aboveground Liquid Storage Systems

P. SSPC Steel Structures Painting Council/NACE - National Association of Corrosion Engineers: SSPC-SP 6/NACE No. 3, Commercial Blast Cleaning, SSPC-SP 10/NACE No. 2, Near-White Blast Cleaning

Q. STI - Steel Tank Institute

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Perform work in accordance with NFPA 22 and authorities having jurisdiction.

C. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

D. Welders Certification: In accordance with ASME BPVC-IX.

E. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. National Fire Protection Association (NFPA).
2. National Sanitation Foundation (NSF).
3. American Society of Mechanical Engineers (ASME).
4. National Electrical Manufacturers' Association (NEMA).
5. Underwriters Laboratories (UL).

F. Manufacturer shall provide written documentation that the aboveground steel fire protection water storage tank was “Made in USA.” The product must be "all or virtually all" fabricated in the United States, including the 50 states, the District of Columbia, and U.S. territories and possessions.

1.6 QUALIFICATIONS

A. Fabricator/Installer: Company specializing in performing the work of this section with a minimum of 10 years of documented experience building tanks of 10,000 gallons or larger. A list of installations of such tanks shall be furnished as required by the Engineer.

1.7 SUBMITTALS

A. Submit under provisions of Division One.

B. Shop Drawings:

1. Include tank interior and exterior dimensions, actual water storage capacity in gallons, sizes of and dimensioned locations of all tappings, drains, and openings, and required maintenance/access clearances on all sides and above.
2. Include interior and exterior finishes and lining methods, anchors, attachments, lifting points, weight of complete (empty) tank.
3. Submittal must include a palette of finished color options (exterior color, color, any exterior trim color) for the tank. Include a complete description of the coating(s) and name(s)of the color(s).

C. Product Data:

1. Shop drawings shall be submitted for review prior to fabrication of any of the water supply tanks and/or accessories.
2. Dimensioned tank fabrication plans, including construction details, all penetrations and accessories, and specification on tank fabrication, penetration and finishing.
3. Cut sheets for tank fill valves, level controls, accessories, and alarms showing all features.
4. Material and coating specifications.
5. Drawing of alarm/control panel, with information including front panel elevation, nameplate text, component list and wiring diagram.
6. Drawing for the tank(s) shall be certified by a Structural Engineer, registered in the State of Texas and shall bear his seal and signature.
7. Technical Data Sheets on NSF 61 compliant internal protective lining.
8. Design Force Calculations for seismic shall be in accordance with AWWA D100, Section 13, IBC or as adopted by the local jurisdiction.

9. Design Force Calculations for dead, roof and wind loads shall be calculated in accordance with AWWA D100, Section 3, IBC or as adopted by the local jurisdiction.

D. Manufacturer's Installation Instructions: Indicate assembly and support requirements and installation, operation, and maintenance instructions.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver to, store, protect and handle products on site under provisions of Division One.

B. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

C. Protect aboveground vertical single-wall steel water storage tank for fire suppression during delivery, storage, handling and installation to prevent damage.

1.10 WARRANTY

A. Provide five year warranty under provisions of Division One.

B. From the date of shipment and for the period indicated above, the tank manufacturer shall:

1. Warrant its products to be free from defects in material and workmanship. The warranty shall be limited to repair or replacement of the defective part(s).
2. Warrant aboveground vertical single-wall steel water storage tank for fire suppression against structural failure due to defective materials or poor workmanship.
3. Warrant interior and exterior coatings of aboveground vertical single-wall steel water storage tank for fire suppression against defects under normal usage conditions.

PART 2 - PRODUCTS

2.1 WELDED STEEL WATER TANK FOR PRIVATE FIRE PROTECTION

A. Acceptable Manufacturers

1. Highland Tank and Manufacturing Company, Inc.
2. CST Industries

B. Aboveground vertical cylindrical single-wall steel water storage tank(s) for fire-suppression water near atmospheric pressure. The water storage tank:

1. 1.Must be fabricated with a liner certified to NSF 61: Drinking Water System Components - Health Effects.
2. 2.Must be installed aboveground, at or near grade level.

C. Nominal water storage tank capacity: As indicated on the Drawings.

D. Nominal water storage tank dimensions: As indicated on the Drawings.

E. Conformance:

1. The fire protection water storage tank shall be designed and fabricated in accordance with UL 142 Standard for Steel Aboveground Tanks, Single-Walled construction and AWWA D100 Welded Carbon Steel Tanks for Water Storage.
2. Pressure testing of new tank. The fire protection water tank, welds, seams and connecting fittings must be factory-tested for tightness using standard engineering practices. Tank must be guaranteed by the manufacturer to be watertight.
3. Storage tank shall be coated for potable water service in accordance with AWWA D102.
4. Storage tank liner shall be certified to NSF 61 Drinking Water System Components - Health Effects.
5. The fire protection water storage tank shall have the structural strength to withstand static and dynamic hydraulic loading while empty and during operating conditions.

F. Construction:

1. The fire protection water storage tank shall be cylindrical, vertical, atmospheric-type steel tank intended for storage of fire-suppression water.
   a. Water storage tank shall be of single-walled construction.
   b. Water storage tank shall be fabricated of mild carbon steel with shell seams of continuous lap weld construction.
   c. The water storage tank shall be fabricated, inspected and pressure tested for leakage before shipment from the factory by manufacturer as a completely assembled, single vessel ready for installation. The water storage tank shall be a pre-packaged, pre-engineered, ready to install unit. Sectionalized, bolted steel storage tanks are not permissible.
   d. A means of grounding the tank shall be provided.
2. Loading Conditions - Water storage tank shall meet the following design criteria:
   a. Internal Load - Water storage tank shall withstand a 5-psig air test (3-psig for >12') with a 5:1 safety factor.
   b. Vacuum Test - To verify structural integrity, water storage tank shall be designed to withstand a vacuum test to 11.5" of mercury.
   c. Ancillary Equipment - Water storage tank shall be capable of supporting internal equipment platforms, drop/fill/suction tubes, and ladders when installed according to storage tank manufacturer's current installation instructions.
3. Product Storage: Tank shall be capable of storing water with a specific gravity up to 1.1.
4. Threaded NPT Fittings: Stainless Steel (to prevent corrosion in threaded area).

5. Threaded fittings with thread protectors shall be supplied as follows: (1) 3 inch diameter, intended for tank drainage, located as close as possible to the bottom of the tank and oriented toward drainage destination.
6. Flanged Fittings: Minimum 150 psi ANSI flanged fittings with flange protectors shall be supplied as indicated on the Drawings.
7. Manholes shall be provided as indicated on the Drawings and per AWWA D100 requirements:
    a. Provide a minimum of two (2) manholes within the first ring.
    b. Manholes shall conform to AWWA D100, circular, minimum 30-inches in diameter.
    c. Manhole covers shall have surface handles.
    d. For hatches weighing more than fifty (50) pounds, provide a davit or hinges.
8. Roof access hatches, each with hinged cover and locking hasp and conforming to AWWA D100 and NFPA 22 shall be provided. One shall be located near the roof ladder and a second roof hatch shall be placed 180 degrees from the primary roof hatch.
9. Overflow: Provide an overflow to ground in accordance with AWWA D100 and City of Houston requirements. The overflow shall terminate near grade and be directed away from the foundation for discharge to an approved drainage inlet structure. The outlet(s) of the overflow riser shall be covered with a non-corrodible metallic screen with openings no larger than #100 mesh.
10. Vent:
    a. A vent assembly no less than one pipe size smaller than the overflow in accordance with AWWA D100 and City of Houston requirements shall be furnished and installed above the maximum water level of sufficient capacity so that as maximum design rate of water fill or withdrawal, the resulting interior design pressure / vacuum will not exceed = 2.0 / -0.5 ounces per square inch.
    b. The overflow pipe shall not be considered to be a tank vent.
    c. The vent shall be so designed in construction as to prevent the entrance of birds and/or animals by including a non-corrodible metallic screen with openings no larger than #100 mesh. If the tank is located in an area where heavy frost is common during the winter months an additional pressure / vacuum relief must also be provided.
11. Pump Suction: A flanged pump suction pipe complete with long radius elbow and anti-vortex plate shall be provided inside the tank as indicated on the Drawings and in accordance with NFPA 20 and NFPA 22 requirements.
12. Corrosion Protection System:
    a. Exterior Protective Coating:
        1) Surface Preparation: Steel Grit blast - SSPC-SP 6/NACE No.3 Commercial Blast Cleaning.
        2) Finish: AWWA D102 OCS #4 Acrylic polyurethane high performance finish paint system, 5-7 mils dry film thickness, applied on the shell and heads. Color to be Reflective White with Gloss Finish OR as directed by Architect/Owner.
    b. Interior Protective Coating:
        1) Surface Preparation: Steel Grit blast - SSPC-SP 10/NACE No. 2, Near-White Blast Cleaning.

2) Finish: Internal surfaces coated with 15 mils dry film thickness HighDRO®-Liner Plus Polyurethane Lining or pre-approved equivalent.
3) The lining must comply with NSF 61 - Approved for potable water.
4) The liner shall be applied on all internal surfaces in accordance with AWWA D102, ICS #4.

13. Lifting lugs: Lifting lugs shall be provided at balancing points to facilitate handling and installation.
14. Anchoring: Anchor Chairs shall be provided in accordance with requirements of calculations for seismic and wind loads determined in accordance with the IBC.
15. Identification plates: Permanent plates to be affixed in prominent location(s) and be durable and legible throughout equipment life.

G. Tank Accessories:

1. Exterior Ladder(s):
   a. Ladder(s) shall be of steel construction and designed in accordance with OSHA standards and acceptable engineering practices, located as indicated on the Drawings.
   b. Safety Cage and/or intermediate step off platform for ladder shall be provided should height of ladder dictate the requirement of these items.
2. Stairway: Provide an external stairway to allow access to top of tank for filling and/or maintenance that complies with applicable OSHA standards (treads, risers, handrails, etc.) and building codes.
3. Platforms and Walkways: Platforms and Walkways shall be of steel construction with fiberglass decking and designed in accordance with OSHA standards and acceptable engineering practices. Platform/walkway shall be located offset from tank center-line to provide access to tank fittings, as indicated on the Drawings. Platform/walkway shall include post and chain access to tank on one side, and solid railing on the opposite side.
4. Roof Perimeter Guardrails: Two partial perimeter guardrails and toe board around the perimeter of the deck shall be provided and installed in accordance with NFPA 22.
5. Internal Ladder: Aluminum or stainless steel ladder shall be manufactured and installed in accordance with OSHA 1910.27, utilizing HighDRO®-Liner Plus Polyurethane Lining (or pre-approved equivalent), NSF 61 approved for potable water, minimum 15 mils dry film thickness.

2.2 FILL VALVES (SOLENOID OPERATED)

A. Fill valve sizes shall be as indicated on the Drawings, be suitable for the indicated flow rate, and each valve shall be capable of re-filling the tank at a minimum rate of 150% of the associated fire pump capacity, per NFPA 20.

B. Fill valves shall be Cla-Val 136 series, fast acting solenoid control valves, operating on-off upon receiving an electrical signal to the solenoid pilot control. Provide minimum 150 psi pressure class, complete with bronze trim, flanged end connections, and -X46A flow clean strainer.

C. Provide valves complete with appurtenances, control panel and wiring as part of a piped fill valve station system. Station shall be accessibly located, either wall-mounted or free-standing rack-mounted, as indicated on the Drawings.

2.3 WATER LEVEL ALARM SYSTEM

A. General Requirements: Contractor shall provide an integrated electrode level monitoring and alarm system as manufactured by Cougar Controls for the tank. The system shall be completely wired and tested prior to shipment. All equipment shall be new. Complete electrical diagrams, dimensional drawing and functional systems description shall be provided to the Engineer for approval.

B. Control System Requirements: The work included in this section shall consist of furnishing all level control relays, terminals, controls, level sensing equipment, alarms, electrode fittings and electrodes, and all other apparatus and accessories specified or necessary for complete electrical control systems. These systems shall be the unit responsibility of one supplier.

C. The UL listed level monitoring and alarm control panel shall be a NEMA Type 4X fiberglass enclosure, Cougar Controls CCXXLC series and shall include the following:

1. Four Liquid Level relays similar to Warrick Series 16 control.
2. “Power On” light.
3. Audible alarm bell with silencing pushbutton.
4. High & Low level alarm lights with nameplates.
5. Auxiliary alarm contacts for remote alarm device.
6. Numbered terminal strip for field connections to electrodes and remote alarm devices.
7. Electrode Fittings & Electrodes.

D. Each tank shall have a Warrick Wire Suspended Electrode Fitting Series 3G or equivalent.

E. Provide required amount of Warrick type 3Z1A Electrode Suspension Wire and type 3W2 SS Wire Suspended Electrodes for each tank. Provide two system reference electrodes, one high level and one low level.

F. Electrode set and arrangement of electrodes from top of tank down for each tank:

1. No. 1 - High Level Alarm
2. No. 2 - High Level Reference
3. No. 3 - Low Water Alarm
4. No. 4 - Low Level Reference

G. Control System Instructions: A Representative of the control system manufacturer shall be present for a minimum of one day to supervise the final adjustment of the control systems after installation is completed and to instruct the operating personnel in the use of this equipment. The manufacturer shall maintain a local service organization and spare parts available from local stock.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Install tanks in accordance with manufacturer's instructions and to NSF 61, UL, and NFPA 20 and NFPA 22 requirements.

B. Coordinate with piping and related work to achieve a fully operating and compliant system.

C. No modifications shall be made to the water storage tank without the prior written approval of the manufacturer and the Engineer. This includes any welding on tank shell, adding penetrations, modifying the tank structure, or repairing damage that might affect the integrity of the water storage tank. Unauthorized modifications will void warranty.

D. Water storage tank shall be handled, lifted, stored, and secured in accordance with the manufacturer's instructions.

E. Securely store the tank at the job site. The location should be selected to minimize tank relocations as work progresses.

F. Always store tanks in a secure area on level ground. Tanks may be stored outside. If necessary, tie down tanks with hold-down lugs to prevent movement due to wind.

G. Before any amount of liquid is stored in a tank, even on a temporary basis, the tank must be installed according to manufacturer’s installation instructions.

H. Provide a complete system of electric, self-regulating type, freeze protection heat tracing, insulation, and aluminum jacketing for all exposed water piping, valves, and appurtenances.

3.2 PREPARATION AND TANK INSTALLATION

A. Foundation for tank:

1. Shall be in accordance with AWWA D100 Section 12 or in accordance with the design of the civil/structural Engineer of Record.
2. Shall be capable of supporting the weight of the tank and associated equipment when full.
3. Shall be designed to prevent tank movement.

B. Water storage tanks located in areas subject to flooding must be protected against flotation.

C. Air test:

1. Perform air test of water storage tank above ground before installation in accordance with manufacturer’s installation instructions or with PEI/RP200.
2. Test Pressure: 5 psi maximum
3. Bubble solution applied to welded seams.

D. Before placing water storage tank on reinforced concrete pad:

1. Remove dirt clods and similar foreign matter from storage tank.
2. Visually inspect storage tank(s) for damage.
3. Notify site supervisor of damage to storage tank.
4. Repair any damaged areas of storage tank coating in accordance with manufacturer's tank installation instructions.

E. Install tank in accordance with manufacturer's tank installation instructions and PEI/RP200.

F. Tank handling:

1. Ensure equipment to handle water storage tank is of adequate size to lift and lower storage tank without dragging, dropping, or damaging storage tank or tank's coating
2. Carefully lift and lower water storage tank with cables or chains of adequate length attached to lifting lugs provided
3. Use spreader bar where necessary
4. Do not use chains or slings around water storage tank's shell
5. Maneuver storage tanks with guidelines attached to each end of the tank

G. Factory supplied saddles for field erection.

1. Carefully position and lower the storage tank until properly set in a vertical position.
2. Confirm that the tank base rests uniformly on the concrete pad.
3. Ensure that anchor chairs and hold-down anchor bolts align.
4. Securely fasten the anchor chairs to the anchor bolts.
5. The storage tank shall be installed in an upright level position.

H. Plugs:

1. Remove plugs at unused water storage tank openings, add pipe compound, and reinstall plugs in unused openings
2. Do not cross-thread or damage storage tank fittings when replacing plugs or installing tank piping

I. Piping:

1. Piping shall be installed in accordance with Sections 21 00 00 and 21 13 13.
2. All piping shall be externally supported so that the weight of the piping is not transferred to the tank or connection.

J. Before placing water in tank, perform final inspection: Visually inspect water storage tank, tank coating, and pipe connections.

3.3 START-UP, OPERATION, AND INSPECTION

A. Tank shall be started, operated and maintained according to manufacturer's installation instructions in effect at time of installation.

B. Filling the tank shall be the responsibility of the Contractor.

C. Any calibration and start-up of ancillary equipment shall be performed by factory-trained and qualified personnel.

D. The tank installer should perform periodic walk-around inspections to identify and repair areas of damage to the tank or the coating and check for proper drainage around the tank area. Should ground conditions change or settlement occur, take the appropriate steps to maintain proper drainage and prevent standing water near or under the tank area.

E. It is imperative that the tank exterior be inspected periodically to ensure that the integrity of the coating is maintained:

1. The frequency of periodic repainting will be based upon environmental factors in the geographic area where the tank is located.
2. The coating selected should be supplied by the tank manufacturer and deemed suitable for use with the current coating.

END OF SECTION

SECTION 22 02 00

BASIC MATERIALS AND METHODS FOR PLUMBING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departure and the reasons therefore shall be submitted to the Architect/Engineer for approval as soon as reasonably practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is equal to that specified.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent Drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings, or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to: materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Plumbing and Fire Protection items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details with regards to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building/job-site, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least seven (7) working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified elsewhere, or necessary for complete and functioning plumbing systems shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the Commissioning process as required; including, but not necessarily limited to: meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed Shop Drawings.

B. All piping, fixture, or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit Shop Drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the owner.

D. Additional coordination with Electrical Subcontractor may be required to allow adequate clearances of electrical equipment, fixtures, and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts, or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the piping, fixtures and equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting is included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to plumbing systems.

C. Furnishing and installing all required plumbing equipment, control relays and electrical interlock devices, conduit, wire and junction boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of Owner occupancy, or the date all punch list items have been completed, or the date final payment has been received. Refer to Division 01 for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such times as the project is ready to receive the equipment, pipe or valves - properly protected from incidental damage and weather damage.

C. Damaged equipment, valves or pipe shall be promptly removed from the site and new, undamaged equipment, valves and pipe shall be provided in its place promptly with no additional charge to the Owner.

1.9 NOISE AND VIBRATION

A. The plumbing systems and the component parts thereof shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate pipe and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect/Engineer, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 APPLICABLE CODES

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection, relocation, and upgrade of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards.

D. Such codes and standards shall include, but not necessarily be limited to:

1. American Standards Association, ASA.
2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
3. American Society of Mechanical Engineers, ASME.
4. American Society of Plumbing Engineers, ASPE.
5. American Society of Testing Materials, ASTM.
6. American Water Works Association, AWWA.
7. National Bureau of Standards, NBS.
8. National Fire Protection Association, NFPA.
9. UL, LLC (formerly Underwriters Laboratories).
10. FM Global.
11. International Energy Conservation Code, IECC.
12. International Fire Code.
13. International Fuel Gas Code.
14. International Plumbing Code.

E. Where differences exist between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Architect/Engineer in writing of all differences.

F. When directed in writing by the Architect/Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards. Correct the deficiencies and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver new to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its Subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 2009 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings. It will not be the province of the Specifications to address any part of the work which the Drawings can fully convey in every particular and such omission shall not to relieve the Contractor from carrying out portions of work indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least seven (7) working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution by made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing at least ten (10) days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification indicates that products of similar design and equal construction from the list of acceptable manufacturers may be used, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outlined herein.

I. Where equipment other than that used in the design as specified or shown on the Drawings is provided (either from an acceptable manufacturer list or by submittal review), it shall be the responsibility of the Contractor to coordinate space requirements, building provisions and connection requirements with all trades bear any additional costs.

J. Where permission to use a substitution product, material, or method is granted by the Owner or Engineer in writing, the Contractor shall bear full responsibility for the implementation of that substitution. Specific responsibilities shall include, but shall not be limited to, the following:

1. Verifying that the substituted item will fit in the space available. This shall include allowances for all code required clearances and manufacturer's maintenance and service clearances.
2. The coordination and provision of all necessary supports, hangers, and appurtenances. Hanger spacing shall be adjusted accordingly and any additional hangers or supports required shall be provided.
3. The coordination and provision of all necessary insulation, firestopping provisions, etc.
4. Adherence to manufacturer's published installation recommendations.
5. Adherence to requirements of the Authority Having Jurisdiction (AHJ) and provision of a code compliant installation.
6. Changes to architectural, structural, electrical, mechanical, and plumbing requirements as a result of the substitution.
7. Bearing any additional costs and time impact and providing any necessary redesign. The Owner will bear no such cost and make no time allowances.
8. Coordination of plumbing and electrical requirements and utility provisions with the Mechanical and Plumbing Design Documents and all other trades, including Division 26.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a written acceptance allowing the substitutions.

1.13 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of Shop Drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty (30) day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive Shop Drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all Shop Drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on Shop Drawings and submittals.

C. Equipment and materials submittals and Shop Drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of Shop Drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where Shop Drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop Drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The Contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous Shop Drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all Shop Drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without Shop Drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not necessarily limited to, the following items:

1. Basic Materials.
2. Plumbing Fixtures and Valves.
3. Supports and Carriers.
4. Floor Drains, Roof Drains, and Cleanouts.

5. Interceptors/Traps (All Types).
6. Water Heaters and Boilers.
7. Expansion Tanks.
8. Water Softeners.
9. Water Treatment Equipment.
10. Water Filters.
11. Domestic Water Booster Pumps.
12. Fire Pumps and Jockey Pumps.
13. Storm, Sanitary, and Wastewater Pumps and Ejectors.
14. Fire Pump and Jockey Pump Controllers.
15. Domestic Water and Fire Protection Break Tanks.
16. Backflow Preventers.
17. Plumbing Piping.
18. Piping, Vessel, and Equipment Insulation.
19. Air Compressors and Air Dryers.
20. Expansion Fittings and Devices.
21. Variable Frequency Drives.
22. Noise and Vibration Controls.
23. Pipe and Equipment Hangers and Supports.
24. Plumbing Specialties.
25. Test, Adjust and Balance Reports.
26. Testing, Adjusting and Balancing Contractor Qualifications.
27. Coordination Drawings.

I. Refer to other Division 22 sections for additional Shop Drawing and submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, equipment, and other materials. Include the following:
   a. Wall locations and types.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal and space for equipment disassembly required for periodic maintenance.
   e. Equipment connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Routing of storm, sanitary sewer piping and plumbing piping.
   h. Fire-rated wall and floor penetrations.
   i. Sizes and location of required concrete pads and bases.
   j. Valve stem movement.

k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting Shop Drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 22.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work; precise locations of all concealed pipe; locations of all valves, controls and operable devices; and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Record Drawings shall indicate, at a minimum, the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices located and numbered, unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion fittings, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
4. Contract Modifications, actual equipment and materials installed.

E. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F. If the Contractor does not keep an accurate set of Record Documents, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G. Upon completion of the Work, the Contractor shall submit three (3) full size sets of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS
DATE:
(NAME OF GENERAL CONTRACTOR)
BY: _____
(SIGNATURE)
(NAME OF GENERAL CONTRACTOR)
BY: _____
(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled dates for each test. This detailed completion and test schedule shall be submittal at least ninety (90) days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit four (4) copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in other Sections of Division 22.

1.17 OPERATIONS AND MAINTENANCE MANUALS

A. Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 22. In addition to the requirements of other Sections, this shall include operational, trouble-shooting, and routine mainenance information for fixtures, specialties, and equipment.

1. Identifying names, name tags designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.

5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
8. Servicing instructions and lubrication charts and schedules.
9. Equipment and motor name plate data.
10. Wiring diagrams.
11. Exploded parts views and parts lists for all equipment and devices.
12. Color coding charts for all painted equipment and conduit.
13. Location and listing of all spare parts and special keys and tools furnished to the Owner.
14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B. Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow 1/4” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Plumbing Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 22 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C. In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E. Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel.

B. The Owner's operator training shall include a minimum of 12 hours of on- site training in three (3) shifts of four (4) hours each.

C. Before proceeding with the instruction of Owner’s Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he or she has a proper understanding of the operation and maintenance of the systems and then resubmit the signed outlines.

D. Refer to other Sections of Division 22 for additional Operator Training requirements.

1.19 FINAL COMPLETION

A. At the completion of the work, all equipment, operable appurtenances, and systems shall be tested. All faulty equipment and material shall be repaired or replaced. Refer to other Sections of Division 22 for additional requirements.

B. Clean and adjust all fixtures, flushometers, valves and operable devices. Replace faulty or otherwise damaged parts immediately prior to final acceptance.

C. Touch up and/or refinish any scratched equipment and devices immediately prior to final acceptance. This shall be acceptable only for minor superficial scratches, the determination of which rests solely on the judgment of the Architect or Engineer.

1.20 CONTRACTOR'S GUARANTEE

A. Use of the Plumbing systems to provide temporary service during the construction period shall not be allowed without written permission from the Owner, and, if granted, shall not be cause for the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one (1) year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air compressors shall have parts and labor guarantees for a period of not less than five (5) years beyond the date of final acceptance.

E. Refer to other Sections of Division 22 for additional guarantee or warranty requirements.

1.21 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for re-use by Architect/Owner or others on extensions of this project or on any other project. Any such re-use or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any re-use or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with “Buy American Act.”

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks unless indicated otherwise.

C. All access panels located in wet areas such as toilet rooms, locker rooms, shower rooms, natatoriums, kitchens, and any other wet areas shall be constructed of stainless steel.

D. Access doors shall be as follows:

1. Plastic Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.2 EQUIPMENT PADS

A. Provide four (4) inch high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

B. Provide six (6) inch high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Provide a four (4) foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in other Divisions (10, 11, 12, 13, 21, 22, etc.) for additional rough-in requirements as necessary and provide accordingly.

3.2 PLUMBING INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of plumbing and fire systems, materials, and equipment. Comply with the following requirements:

1. Coordinate plumbing and fire protection systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, leave-outs, and other openings in building components during progress of construction to allow for plumbing installations.
4. Coordinate the installation of required supporting devices, sleeves, and pathways to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of plumbing and fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access panels or doors where valves, operable devices, and equipment are concealed behind finished surfaces. Refer to Article 2.1 of this Section and to Architectural documents for specifications and locations.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.
14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.
15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.

17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, valves, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Plumbing Equipment:
    a. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop Drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chains. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the Record Drawings.

3.3 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of plumbing equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Article 1.11 DEFINITIONS AND SYMBOLS for definition of "Installer."

C. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, equipment, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.4 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and the Architect/Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

B. Start-up for major plumbing and fire protection equipment shall be performed by a factory authorized technician. Such equipment shall include, but not necessarily be limited to, the following: domestic water boilers and packaged water heating systems, water softeners, ultra-pure water equipment systems, domestic water booster pumps, fire pumps, and break tank level alarm systems. Refer to other Sections of Divisions 21 and 22 for additional requirements.

3.5 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, utilities, equipment and other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by this Contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe, supports, and hangers. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. Ensure existing piping and equipment to remain that is adjacent to and impacted by the scope of Work is properly supported, fastened, and secure.

E. During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

F. Certain work during the demolition phase of construction may require overtime, night time, or weekend shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

G. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately and disposed of lawfully.

H. Equipment, piping or other potential hazards to the working occupants of the building or the general public shall not be left overnight outside of the designated working or construction area.

I. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

J. Include in the contract price all rerouting of existing pipe, utilities, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Provide all temporary pipe, utilities, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.

K. All existing plumbing fixtures, pipe, utilities, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

L. Pipe, utilities, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, utilities, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

M. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner’s representative in order to protect systems that shall remain in service.

N. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

O. Refer to Architectural Demolition and/or Alteration plans for actual locations of walls, ceiling, etc., being removed and/or remodeled.

END OF SECTION

SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use. Provide electric motors, control panels, control and safety devices, and control wiring when specified or as required for proper operation of electrical systems associated with plumbing equipment and appurtenances.

B. WORK SPECIFIED ELSEWHERE:

1. Painting.
2. Power control wiring to motors and equipment.

1.3 WARRANTY

A. Warrant the Work specified herein for one year and motors for five years beginning on the date of substantial completion against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.

C. MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.

D. Refer to Division One for additional information.

1.5 DELIVERY AND STORAGE

A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS

A. APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.

1. Baldor
2. Marathon
3. Leeson-Lincoln Electric
4. General Electric
5. Westinghouse

B. TEMPERATURE RATING: Provide insulation as follows:

1. CLASS B: 40 degrees C maximum.
2. CLASS F:
   a. Between 40 degrees C and 65 degrees C maximum.
   b. Totally enclosed motors.

C. STARTING CAPABILITY: As required for service indicated five starts minimum per hour.

D. PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.

1. UP TO 3/4 HP: Provide electronically commutated brushless DC single phase motors with built-in inverter and microprocessor-based control.
2. 1 HP AND LARGER: Provide squirrel-cage AC induction polyphase motors.
3. Name plate voltage shall be the same as the circuit's normal voltage, serving the motor.

E. SERVICE FACTOR: 1.15 for polyphase; 1.35 for single phase.

F. FRAMES: U-frames 1.5 hp. and larger.

G. BEARINGS: Provide sealed re-greasable ball bearings; with top mounted zerc lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:

1. Design for thrust where applicable.
2. PERMANENTLY SEALED: Where not accessible for greasing.
3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional horsepower motors or polyphase requiring minimum noise level.

H. ENCLOSURE TYPE: Provide enclosures per applications as follows:

1. CONCEALED INDOOR: Open drip-proof (ODP).
2. EXPOSED INDOOR: Splash-proof.
3. OUTDOOR TYPICAL: Type III, totally enclosed fan-cooled (TEFC).
4. OUTDOOR WEATHER PROTECTED: Weather protected II (WPII).
5. HAZARDOUS LOCATIONS: Explosion-proof.

I. OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

J. NOISE RATING: "Quiet" except where otherwise indicated.

K. EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE Test Procedure 112A, Method B, including stray load loss measure.

NEMA Efficiency - 1800 RPM Synchronous Speed		
Motor Horspeower	Index Letter	Minimum Efficiency %
3 - 5	G	89.5
7.5	G	91.0
10	F	91.7
15 - 20	E	93.0
25 - 30	E	93.6
40	D	94.1
50	C	94.5
60	C	95.0
75	C	95.0
100 - 125	B	95.4
150 - 200	B	95.8
NEMA Efficiency - 1200 RPM Synchronous Speed		
Motor Horspeower	Index Letter	Minimum Efficiency %
3 - 5	G	89.5
7.5	G	90.2
10	F	91.7
15	F	91.7
20	E	92.4
25 - 30	E	93.6
40 - 50	D	94.1
60	D	94.5
75	C	94.5
100 - 125	C	95.0
150 - 200	B	95.4

2.2 MOTOR CONTROLLERS (STARTERS)

A. All motor controllers (for equipment furnished under Division 22) shall be furnished under Division 22 and installed under Division 26 unless otherwise noted on the plans.

1. Starters shall be provided for 3 phase motors 1 horsepower and greater.

B. Motor starters shall be furnished as follows.

1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.
2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.
4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.
5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.
6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 22. Motor starter controls shall be mounted in the starter enclosure cover.
7. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
8. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.
9. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.
10. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located by cooling towers, fountains, or similar locations.

11. POWER MONITOR: Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving all 3 phase motors. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturers.

1. Siemens.
2. Square D.
3. General Electric.
4. Eaton.

2.3 COMBINATION MOTOR STARTERS

A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.1/B, except as modified herein.

B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Division 26.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturers.

1. Siemens.
2. Square D.
3. General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors' price shall include all items required as per manufacturer's requirements.

C. Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.

D. Install rotating equipment in static and dynamic balance.

E. Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.

F. Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION

SECTION 22 05 16

EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the fittings and items covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Expansion joints and compensators.
2. Pipe loops, offsets, and swing joints.

1.3 RELATED WORK

A. Section 22 02 00 - Basic Materials and Methods for Plumbing

B. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

C. Section 22 10 00 - Plumbing Piping

1.4 REFERENCES

A. IAPMO (UPC) - Uniform Plumbing Code.

B. NSF 61 - Drinking Water System Components - Health Effects.

1.5 PERFORMANCE REQUIREMENTS

A. Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.

B. Expansion Calculations:

1. Installation Temperature: 50 degrees F (10 degrees C).
2. Hot Water Heating: 210 degrees F (99 degrees C).
3. Domestic Hot Water: 140 degrees F (60 degrees C).
4. Safety Factor: 30 percent.

C. Pipe sizes indicated are to establish a minimum quality of compensator. Refer to manufacturer's literature for model series for different pipe sizes.

1.6 SUBMITTALS

A. Submit shop drawings under provisions of Division One.

B. Product Data:

1. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.
2. Pipe loops, offsets, and swing joints: Indicate temperature rise, developed lengths, pipe size, material expansion coefficient-allowable stress-modulus of elasticity, and final calculated amount of expansion. Indicate bend, loop, offset & return dimensions coinciding with the calculated expansion.

C. Design Data: Indicate selection calculations.

D. Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of expansion joints, fittings, anchors, and guides.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include adjustment instructions.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B. Design expansion compensation system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the state where the project is located.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, project and handle products to site under provisions of Division One.

B. Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.11 WARRANTY

A. Provide five year warranty under provisions of Division One.

B. Warranty: Include coverage for leak free performance of packed expansion joints.

1.12 EXTRA MATERIALS

A. Furnish under provisions of Division One.

PART 2 - PRODUCTS

2.1 EXPANSION JOINTS

A. Bellows Type (Based on 4" Pipe):

1. Manufacturers:
   a. VMC Group, Style EB
   b. Triplex, Model Resistoflex R6905
   c. Mercer Rubber Company, Style 803 or 805 (Mason Industries)
   d. Metraflex
2. Body: Monel wire reinforced molded TFE teflon bellows, multiple arch.
3. Pressure Rating: 70 psig WSP and 250 degrees F (66 degrees C).
4. Maximum Compression: 1 inch.
5. Maximum Extension: 1 inch.
6. Maximum Offset: 1/2 inch.
7. Joint: ASA standard ductile iron flanges, integral molded gasket.
8. Size: Use pipe sized units.
9. Accessories: Control rod limit bolts.
10. Application: Steel piping 8 inch and under.

B. Pre-manufactured Loop Type:

1. Manufacturers:
   a. Flexicraft Industries
   b. Metraflex MLS-UPC-80 series
2. Materials of construction: Copper custom 180 degrees bend (or 90 degree elbows with spool), copper 90 degree elbows for connections to piping, bronze hose and braid.
3. Certifications: NSF 61 lead-free compliant, IAPMO (UPC) approved.
4. Working Pressure: No less than 200 psi at 250 degrees F.
5. Allowable Movement: +/- 4 inches.
6. Labeled from the manufacturer and provided complete with attached support bracket and drain plug.
7. Size: Same as piping being served.
8. Installation: In strict accordance with manufacturer's recommendations, including support.
9. Application: Copper piping 4 inch and under.

2.2 ACCESSORIES

A. Pipe Alignment Guides to Direct Axial Movement:

1. Manufacturers:
   a. Triplex, Model Flexonics
   b. Metraflex
2. Welded steel construction bolt together two piece design, frame with four mounting holes, shop painted, spider type guide, exact style/model as necessary for bare or insulated pipe to match size and thickness as appropriate, 4 inch movement standard.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide miscellaneous metals to rigidly anchor pipe to building structure. Provide pipe guides so that movement takes place along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

C. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

3.2 MANUFACTURER'S FIELD SERVICES

A. Prepare and start systems under provisions of Division One.

B. Provide inspection services by manufacturer's representative for final installing and to certify the nstallation is in accordance with manufacturer's recommendations and expansion joints and accessories are performing satisfactorily.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Pipe, and equipment hangers, supports, and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.3 RELATED WORK

A. Section 22 02 00 - Basic Materials and Methods for Plumbing

B. Section 22 07 19 - Plumbing Piping Insulation

C. Section 22 10 00 - Plumbing Piping

D. Section 22 11 26 – Propane Gas Piping Systems

1.4 REFERENCES

A. ASME B31.1 - Power Piping.

B. ASME B31.9 - Building Services Piping.

C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.5 QUALITY ASSURANCE

A. Hangers and Supports for Plumbing Piping: In conformance with ASME B31.1 and ASME B31.9.

B. Hangers and Supports for Plumbing Piping: In conformance with MSS SP-58.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.

C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and Over: adjustable steel yoke and cast iron roller.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

J. Roof Pipe Supports and Hangers: Free-standing manufactured pipe support system with hot dip galvanized steel components and hardware with UV-inhibited injection molded high density/high impact black polypropylene base material. Portable Pipe Hangers, Inc. or approved equal.

For pipes 2-1/2” and smaller	Type PP10-R, with pipe roller support
For pipes 3” through 8”	Type PS-1-2, with pipe roller support
For multiple pipes	Type PSE - Custom

K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal. Hangers: Plastic coated; Unistrut or equal.

L. For installation of protective shields also reference Section 22 07 19.

M. Shields for Vertical Copper Pipe Risers: Sheet lead.

N. Pipe Rough-In Supports in Walls/Chases: Provide pre-formed plastic pipe supports, Sioux Chief “Pipe Titan”, Hold Rite or equal.

2.2 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

A. 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.

2.4 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Lead Flashing: 4 lb./sq. ft. sheet lead for waterproofing.

C. Caps: Steel, 20 gauge minimum; 16 gage at fire resistant elements.

D. Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.5 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.

2.6 SLEEVES

A. All pipe penetrations through walls, floors, floor-ceiling assemblies, etc. shall be sleeved to ensure no direct contact between the pipe and that which it passes through. All installations shall be provided consistent with the fire and smoke safeguards required by the building code per the fire-resistance rating as indicated on the architectural drawings and shall be provided consistent with the assemblies/methods indicated on the architectural drawings.

B. Unless required otherwise (the most stringent requirement shall govern), sleeves for pipes:

1. Through nonfire-resistance-rated floors shall be formed with 18 gage galvanized steel, tack welded to form a uniform sleeve.
2. Through nonfire-resistance-rated walls, through grade beams and foundation walls, and through potentially wet floors shall be formed with schedule 40 steel pipe, galvanized.
3. Through assemblies including but not limited to fire-resistance-rated walls-barriers-partitions, smoke barriers-partitions, etc. shall be schedule 40 steel pipe securely fastened to the rated assembly. All annular spaces shall be firestopped with an approved penetration firestop system (UL listed) compatible with the pipe material and installed per the manufacturer's recommendations.

C. Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.

D. Caulk: Paintable 25-year acrylic sealant.

E. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.7 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.8 FINISH

A. Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX/ HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"

(Cast Iron Pipe)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 inch and over	4'-0"	5/8"

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers. Also reference specific requirements for cast iron piping installation in Section 22 10 00, Part 3 Execution.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. For vertical shaft or chase applications where floor slab supported riser clamps cannot be provided to keep the pipe in alignment and to support the weight of the pipe and its contents, ensure to provide suitable fasteners and hardware, braces, unistrut, structural steel members, etc. to accommodate the pipe installation. Coordinate all such work with the project structural engineer to ensure that necessary members and attachment points are provided accordingly to bear the weight of the functioning piping.

H. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

K. Portable pipe hanger systems shall be installed per manufacturer’s instructions.

3.3 INSULATED PIPING

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation. Secure the full contact area of the saddle to the pipe insulation with 1/8" thick coat of mastic.

C. Shields: Install protective shields MSS Type 40 on insulated piping that has vapor barrier. Secure the full contact area of the shield to the pipe insulation with 1/8" thick coat of mastic.

D. Galvanized sheet metal shields shall span an arc of 180 degrees and shall have dimensions not less than the following:

Nominal Pipe Size	Shield Length	Gauge Thickness
1/4 through 3-1/2 inch	12 inch	18
4 inch	12 inch	16
5 through 6 inch	18 inch	16
8 through 14 inch	24 inch	14
16 through 24 inch	24 inch	12

E. Ensure to provide an insert of high density insulation (calcium silicate) at each hanger/support to prevent the weight of the pipe from otherwise crushing the insulation. This insert material shall be at least as long as the associated protective shield.

F. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct support of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

A. Provide flexible flashing and metal counter flashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D. Seal floor shower mop sink and all other drains watertight to adjacent materials.

E. Provide curbs for mechanical roof installations 8 inches minimum high above roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.6 SLEEVES

A. Set sleeves in position in formwork. Provide reinforcing around sleeves.

B. Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermfiber and 3M caulking and provide floor plate.

C. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with UL listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION

SECTION 22 05 48

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of vibration & sound control products and seismic controls covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Vibration and shock mounting.
2. Flexible pipe connectors.
3. Seismic restraints.

1.3 RELATED WORK

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 10 00 - Plumbing Piping

C. Section 22 30 00 - Plumbing Equipment

1.4 REFERENCES

A. ICC (IBC) - International Building Code.

B. NFPA 99 - Health Care Facilities Code.

C. NSF 61 - Drinking Water System Components - Health Effects.

1.5 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of vibration control and seismic products, of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria (NC) curves for all equipment at full load conditions.

C. Unless indicated otherwise, sound and vibration control products and seismic products shall be provided by a single manufacturer.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. VMC Group

B. Mason Industries, Inc.

C. Kinetics Noise Control, Inc.

D. Vibration Eliminator Co., Inc.

E. Unisource Manufacturing (as specifically noted below)

2.2 GENERAL

A. Provide vibration isolation supports for equipment, piping and appurtenances to prevent transmission of vibration and noise to the building structure that may cause discomfort to the occupants.

B. Provide seismic restraints, supports, and attachments suitable for the applicable seismic loads in seismic design category areas as required by the ICC (IBC) and local code requirements.

C. Where Basis of Design manufacturer and model numbers are indicated, the products of the other listed manufacturers above will be acceptable provided they comply with all of the requirements of this specification.

2.3 BASE MOUNTED PUMPS

A. Provide VMC Group model SP-NR, style E, elastomeric isolation pads consisting of two layers of 3/8'' thick alternate ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate.

B. Pads shall be sized for approximately 40 psi loading and 1/8'' deflection.

C. Provide inertia bases for all base mounted pump applications in which the pumps are to be installed on any floor level other than the ground floor or grade level. Inertia bases shall also be provided for base mounted pump applications in which the associated room where they are housed is in a noise sensitive location, regardless of floor level.

2.4 FLOOR MOUNTED AIR COMPRESSORS, VACUUM PUMPS, AND SIMILAR EQUIPMENT

A. Provide VMC Group model CAL-2 aluminum housed isolators sized for 2” static deflection. Cast iron or steel housings may be used provided they are hot-dip galvanized after fabrication.

B. If floor mounted equipment is furnished with an internal vibration isolation option, provide VMC Group model SP-NRC, style E, consisting of two layers of 1" thick ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate to address high frequency breakout and afford additional unit elevation for required drains. Ribbed elastomeric pads shall be located in accordance with the equipment manufacturer’s recommendations.

2.5 PIPING

A. Provide line size stainless steel flexible connectors at connections to air compressors, domestic boosters, and other pumps (excluding submersible pumps and small circulators).

1. Type 321 SS annular corrugated interior hose.
2. Type 304 SS single braid exterior hose.
3. End connection type(s) as suited for the application and the equipment and piping being served, but in no case welded or soldered ends.
4. Ensure NSF 61 compliance for all potable water applications.
5. When applied with dissimilar pipe materials, dielectric connections must be provided at both ends.

B. For medical gas applications (or similar), flexible connectors at intake and outlet of medical air compressors and vacuum pumps shall be specifically produced for such use:

1. They shall be documented, purged, and brazed to NFPA 99 standards.
2. They shall be cleaned, capped, and bagged in accordance with CGA (Compressed Gas Association) G-4.1.
3. Bronze hose and braid, copper return elbow, and copper sweat end connections. Sizes 2-1/2" through 4" shall utilize stainless steel hose and braid, stainless steel return elbow, and copper sweat end fittings silver brazed to the assembly.
4. Unisource Manufacturing Series 455 "MedFlex"

2.6 CORROSION PROTECTION

A. All vibration isolators shall be designed and treated for resistance to corrosion.

B. Steel components: PVC coated or phosphated and painted with industrial grade enamel. Nuts, bolts, and washers: zinc-electroplated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C. The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the items covered by this Section, with all appurtenances, ready for owner's use.

B. All plumbing piping shall be appropriately labeled.

C. Refer to Architectural Sections for any additional requirements.

1.3 RELATED WORK

A. Section 22 10 00 - Plumbing Piping

B. Section 22 07 19 - Plumbing Piping Insulation

1.4 REFERENCES

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

PART 2 - PRODUCTS

2.1 VALVE AND PIPE IDENTIFICATION

A. Valves:

1. All valves shall be identified with a 1-1/2" diameter brass valve tag with stamped, black or red filled characters. Service designations shall be 1/4" letters and valve numbers shall be 1/2" numbers. Secure tags to valve handles by use of use of copper or Monel wire seals. For any services not identified below, contact Engineer in advance for approval. Service designations:
   a. Domestic cold water: DCW
   b. Domestic hot water: DHW
   c. Domestic hot water return: DHWR
   d. Natural gas: GAS
   e. Compressed air: AIR
2. All valves on the project shall be numbered sequentially, with valves for any one system and/or trade grouped together.

3. Valve tags are not required if the valve is located within 3'-0" of the equipment being served and the service is obvious.
4. Catalog a complete written record of all valves on the project, whether tagged or not. Include manufacturer, model number, size, service, system pressure (if like services with differing pressures are present on the project), location, valve tag data, and a description of the equipment/room/area served. Any valves which must be operated in sequence shall be indicated as such. Prepare a valve chart/schedule with all such information and include this chart/schedule in the project Operating and Maintenance Manual.
5. Mark all valve locations on the record drawings with appropriate identifying symbols or information to align with the above referenced valve chart/schedule. In addition to the O&M submission, provide the Owner with a digital copy (PDF format) of all such information in high-resolution, suitable for printing as full size drawings.
6. Tags and fastenings shall be manufactured by the Seton Nameplate Corporation or approved equal.
7. In addition to tags, all isolation valves serving emergency safety fixtures shall be provided with immediately adjacent clear and permanent signage indicating their purpose so as to avoid accidental shut-off.

B. Pipe Marking:

1. All interior visible piping located in accessible spaces shall be provided with pipe markers. Accessible spaces shall include, but not necessarily be limited to, the following: above accessible ceilings, inside equipment rooms and utility spaces, in attic spaces, in crawl spaces, and in chase spaces, etc. viewable via access panels.
2. All exterior visible piping shall be provided with pipe markers.
3. Peel-off, self-adhesive, sticker type labels shall not be acceptable.
4. Pipe markers shall be manufactured with rigid vinyl PVC, printed with UV resistant ink, abrasion and chemical resistant, suited for indoor or outdoor use and for a service temperature of -40 degrees F to 160 degrees F.
    a. For pipes up to 6” provide cylindrically pre-coiled markers that snap into place without the need for tape or adhesives.
    b. For pipes 6” and larger provide flat snap-around markers installed using manufacturer’s heavy-duty nylon ties or stainless steel strapping.
    c. Markers shall indicate the pipe service, include flow directional arrows, and meet ASME A13.1.
5. Acceptable manufacturers:
    a. Seton Setmark Pipe Markers
    b. Brimar Industries Pipemarker System 1 Pipe Markers
    c. Brady Corporation
6. Markers shall be provided after final insulating, painting, jacketing, etc. of piping and per manufacturer’s installation instructions. Strapping (applies to large diameter markers only) shall be snug but shall not compromise any insulation. All such strapping shall also be cleanly trimmed of excess material.
7. Markers shall be provided in accordance with ASME A13.1 requirements. Specific items indicated below are not intended as a substitute for this complete standard. Markers shall be provided:
    a. On both sides of each floor or wall penetration.
    b. On each side of each tee.

c. On each side of each valve and/or valve group.
d. On each side of each piece of equipment.
e. On straight pipe runs at equally spaced intervals not to exceed 50 feet.
f. In congested areas, on each pipe at the point it enters and exits the area.
g. At the point of connection to each piece of equipment and automatic control valve.
h. Where they are readily visible to personnel from the point of normal approach.
i. With letter height and length of color field according to the size of the pipe served.
j. For non-potable water not less than once per room and at equally spaced intervals not to exceed 20 feet.

8. Color scheme of markers shall be as indicated below and otherwise in accordance with ANSI/ASME color recommendations. Legend color indicates color of legend text and flow directional arrow:

SYSTEM	LABEL COLOR	LEGEND	LEGEND COLOR
Sanitary Sewer	Green	Sanitary Sewer	White
	Green	Plumbing Vent	White
Storm Drain	Green	Storm Drain	White
	Green	Overflow	White
Domestic Water	Green	Domestic Cold Water	White
Domestic Hot Water	Green	Domestic Hot Water	White
Domestic Hot Water Return	Green	Domestic Hot Water Return	White
Fire Protection	Red	Fire Protection	White
	Red	Fire Sprinkler	White
Fuel Gas	Yellow	Natural Gas	Black
	Yellow	Propane Gas	Black
Diesel	Yellow	Diesel Oil	Black
Compressed Air	Blue	Compressed Air	White
Nitrogen	Orange	Nitrogen	Black
Carbon Dioxide	Orange	Carbon Dioxide	Black
Non-Potable Water	Yellow	Caution: Non-Potable Water, Do Not Drink	Black
Deionized Water	Green	Deionized Water	White
Reverse Osmosis Water	Green	R.O. Water	White
Acid Waste	Orange	Acid Waste	Black
		Acid Vent	Black

C. Pipe Painting:

1. The entire fire protection piping system shall be painted red.
2. Pipe painting shall be per the color schedule below or as directed by the Architect. Confirm all color selections with Architect prior to installation, in particular for exposed piping in publicly occupiable areas.

3. All exterior piping shall be painted.
4. All piping subject to corrosive conditions shall be painted. This shall include, but not necessarily be limited to: natatoriums, pool equipment rooms, chemical and metal processing areas, and animal pens.
5. All exposed piping shall be painted (including, but not limited to: piping in mechanical rooms, kitchens, and storage rooms).
6. Paint color schedule:

System	Color
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange
Fuel Gas (except for utility provider installed piping)	Yellow, unless specifically indicated/required otherwise by Architect or AHJ

2.2 EQUIPMENT IDENTIFICATION

A. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. All labeling equipment shall be installed per manufacturer's printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor's price shall include all items as required per manufacturers' requirements.

C. All piping to be painted shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Install primer and a quality latex paint over all surfaces of pipe. For piping subject to corrosive conditions provide a suitable epoxy (spray) coating to all exposed surfaces.

END OF SECTION

SECTION 22 07 16

PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Work specified elsewhere.

1. Basic materials and methods.
2. Piping systems.
3. Air distribution equipment.

1.3 REFERENCES

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ICC (IECC) - International Energy Conservation Code.

D. SCAQMD 1168 - Adhesive and Sealant Applications.

E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.5 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.6 DELIVERY AND STORAGE

A. DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers clearly labeled with flame and smoke ratings.

PART 2 - PRODUCTS

2.1 EQUIPMENT INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

C. A sample quantity of each type insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. Glass mineral wool materials as manufactured by Knauf Insulation, Owens/Corning, Certain-Teed or Johns Manville will be acceptable, if they comply with the specifications.

E. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.

F. All insulation shall comply with minimum requirements of International Energy Conservation Code ICC (IECC) and ASHRAE Std 90.1 I-P.

G. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

H. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Furnish and install piping insulation to:

1. Interior domestic hot water and hot water return piping.
2. Interior domestic cold water piping.
3. Interior domestic cold water piping located in exterior walls and to a point no less than 8'-0" inside the building.
4. Exterior domestic cold water piping.
5. Drain bodies and associated piping.
6. Condensate drainage piping.
7. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D. For insulation purposes, piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer wells, unions, pressure reducing stations, and orifice assemblies.

1.3 RELATED SECTIONS

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment

C. Section 22 10 00 - Plumbing Piping

1.4 REFERENCES

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

D. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.

E. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

G. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C.

H. ICC (IECC) - International Energy Conservation Code.

I. SCAQMD 1168 - Adhesive and Sealant Applications.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver undamaged materials in the manufacturer's unopened containers. Containers shall be clearly labeled with the insulation's flame and smoke ratings.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 PIPING INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.

C. A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

E. All piping insulation shall comply with minimum requirements of International Energy Conservation Code ICC (IECC) and ASHRAE Std 90.1 I-P.

F. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

G. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

H. Any existing piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

2.2 APPROVED MANUFACTURERS

A. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

B. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armacell, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Armaflex elastomeric cellular thermal insulation by Armacell.

D. Phenolic foam insulation shall be as manufactured by Resolco, Inc. (Insul-Phen) or Polyguard (Poly-phen).

E. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products, Inc.

2.3 MATERIALS

A. INTERIOR DOMESTIC WATER PIPE: Provide glass mineral wool pipe insulation in accordance with ASTM C547 with ASJ+ SSL+ jacket.

B. EXTERIOR DOMESTIC WATER PIPE: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "AP Armaflex" with secured aluminum jacketing, or preformed phenolic foam in accordance with ASTM C1126 with secured aluminum jacketing.

C. DRAIN BODIES AND DOWNSPOUTS: Insulate underside of roof and overflow drain bodies, associated horizontal piping, including first turn down to vertical conductor. Insulate chilled water waste lines from drinking fountain to junction with main waste stacks. Insulate branch lines including traps and exposed underside of floor drains receiving cooling coil condensate, same as water piping where exposed to building occupant view. When concealed, insulation may be same as specified for external duct wrap.

D. CONDENSATE DRAINAGE PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "Armaflex Ultra", fire rated for use in environmental air plenums; insulation not required when piping is exposed on roof.

E. ALUMINUM OR STAINLESS STEEL JACKETING: Utilize strap-on type jacketing, banding, and accessories. Provide pre-formed fitting covers for all elbows and tees.

F. ALL SERVICE JACKETING (ASJ+): Vapor retarder jacket for interior applications shall be composed of an aluminum foil layer, reinforced with glass scrim, bonded to a layer of white kraft paper, interleaving with an outer polymer film leaving no paper exposed, complying with ASTM C1136. Vapor retarder jacket for exterior applications shall be composed of a 3-ply composite membrane consisting of a white 0.5 mil polyester film, 1.0 mil aluminum foil, and one 0.5 mil clear polyester film; complying with ASTM C1136.

PART 3 - EXECUTION

3.1 GENERAL

A. All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C. Pipes located outdoors or in tunnels shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

D. All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

E. Provide all piping insulation to comply with the ASHRAE Std 90.1 I-P Minimum Thickness Schedule and as indicated below.

1. Low temperature surfaces - Minimum Insulation Thickness
   a. Exposed exterior domestic water pipe: 1-1/2 inch
   b. Interior domestic cold water pipe: 1 inch
   c. Condensate drain lines: 3/4 inch
   d. Drains receiving condensate: 1 inch
   e. Concealed piping from roof drains: 1-1/2 inch blanket wrap
   f. Exposed piping from roof drains: 1 inch thick rigid with all service jacket
2. Domestic Hot Water and Return Piping - Minimum Insulation Thickness
   a. Pipe sizes 1-1/4 inch and smaller with operating temperatures of 140°F or less: 1 inch
   b. Pipe sizes 1-1/2 inch and larger with operating temperatures of 140°F or less: 1-1/2 inch
   c. Pipe sizes 1-1/4 inch and smaller with operating temperatures greater than 140°F: 1-1/2 inch
   d. Pipe sizes 1-1/2 inch and larger with operating temperatures greater than 140°F: 2 inch

3.2 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, a vapor dam shall be formed between the vapor retarder jacket and the bare pipe. The seal shall be by the applications of vapor retarder mastic to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber covers finished with two brush coats of vapor retarder mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor retarder jacket.

D. At hangers and supports, provide a high density foam insulation insert that extends 2” beyond the shield on each side and a protective shield/saddle to prevent compression/damage. Secure shield/saddle to insulation using mastic. Also reference specific requirements in Section 22 05 29, Part 3 Execution.

3.3 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying Owens Corning Thermafiber in the space between the concrete and the pipe.

B. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

END OF SECTION

SECTION 22 10 00

PLUMBING PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the piping covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Pipe and pipe fittings:
   a. Sanitary drainage piping system.
   b. Storm drainage piping system.
   c. Sub-surface drainage piping system.
   d. Domestic water piping system.
2. Adapters, Transitions, Unions, Couplings, Flanges, Connectors
3. Valves
4. Excavation, Bedding, and Backfill

1.3 RELATED WORK

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment

D. Section 22 07 19 - Plumbing Piping Insulation

E. Section 22 11 12 - Domestic Water Piping - Cross-Linked Polyethylene (PEX)

F. Section 22 11 19 - Plumbing Specialties

G. Section 22 30 00 - Plumbing Equipment

H. Section 22 40 00 - Plumbing Fixtures

1.4 REFERENCES

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.

D. ASME B16.14 - Ferrous Pipe Plugs, Bushings, and Locknuts With Pipe Threads.

E. ASME B16.15 - Cast Copper Alloy Threaded Fittings Classes 125 and 250.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

H. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

I. ASME B16.24 - Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500.

J. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

K. ASME B16.39 - Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300.

L. ASME B16.50 - Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings.

M. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings.

N. ASME BPVC - Boiler and Pressure Vessel Code.

O. 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.

P. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems.

Q. ASSE 1079 - Performance Requirements for Dielectric Pipe Unions.

R. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

S. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.

T. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

U. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

V. ASTM A197/A197M - Standard Specification for Cupola Malleable Iron.

W. ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.

X. ASTM A403/A403M - Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.

Y. ASTM A536 - Standard Specification for Ductile Iron Castings.

Z. ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars.

AA. ASTM A733 - Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples.

BB. ASTM A865/A865M - Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints.

CC. ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

DD. ASTM B1 - Standard Specification for Hard-Drawn Copper Wire.

EE. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire.

FF. ASTM B16/B16M - Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.

GG. ASTM B32 - Standard Specification for Solder Metal.

HH. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

II. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

JJ. ASTM B75/B75M - Standard Specification for Seamless Copper Tube.

KK. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

LL. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).

MM. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

NN. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

OO. ASTM C33/C33M - Standard Specification for Concrete Aggregates.

PP. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.

QQ. ASTM C150/C150M - Standard Specification for Portland Cement.

RR. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

SS. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.

TT. ASTM C1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems.

UU. ASTM C1460 - Standard Specification for Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground.

VV. ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

WW. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

XX. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).

YY. ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

ZZ. ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings.

AAA. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

BBB. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

CCC. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

DDD. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

EEE. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

FFF. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

GGG. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

HHH. ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

III. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.

JJJ. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

KKK. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

LLL. ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

MMM. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.

NNN. ASTM D3311 - Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns.

OOO. ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials.

PPP. ASTM D4976 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

QQQ. ASTM D5926 - Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems.

RRR. ASTM D6707/D6707M - Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications.

SSS. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

TTT. ASTM E438 - Standard Specification for Glasses in Laboratory Apparatus.

UUU. ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

VVV. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

WWW. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

XXX. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

YYY. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

ZZZ. ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings.

AAAA. ASTM F1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems.

BBBB. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

CCCC. ASTM F1548 - Standard Specification for Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications.

DDDD. ASTM F1673 - Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems.

EEEE. ASTM F2618 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems.

FFFF. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding..

GGGG. AWS A5.9/A5.9M - Welding Consumables-Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels- Classification.

HHHH. AWS A5.31M/A5.31 - Specification for Fluxes for Brazing and Braze Welding.

IIII. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.

JJJJ. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.

KKKK. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

LLLL. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.

MMMM. AWWA C209 - Tape Coatings for Steel Water Pipe and Fittings.

NNNN. AWWA C219 - Bolted Sleeve-Type Couplings for Plain-End Pipe.

OOOO. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

PPPP. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.

QQQQ. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.

RRRR. AWWA C651 - Disinfecting Water Mains.

SSSS. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

TTTT. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.

UUUU. 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.

VVVV. NFPA 13 - Standard for the Installation of Sprinkler Systems.

WWWW. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection.

XXXX. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

YYYY. NSF 14 - Plastics Piping System Components and Related Materials.

ZZZZ. NSF 61 - Drinking Water System Components - Health Effects.

AAAAA. NSF 372 - Drinking Water System Components - Lead Content.

BBBBB. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

CCCCC. UL 1285 - Safety Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

D. Foreign pipe, fittings or valves are unacceptable.

E. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed by NSF International.

F. Welding Materials and Procedures: Conform to ASME BPVC and applicable state labor regulations.

G. Welders Certification: In accordance with ASME BPVC-IX.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data and video inspection report under provisions of Division One.

C. Include pipe materials, pipe fittings, valves, and accessories. Provide manufacturer’s catalog information, product certifications, and country of origin. Indicate valve data and ratings.

D. Submit dimensioned detailed drawings and material specifications for pipe isolation and protection systems being provided for void form/carton form/void box installations.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of valves.

C. Include written report and digital video record of waste piping inspection.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.

B. Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E. Provide temporary protective coating on cast iron and steel valves.

F. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

G. Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

A. Perform work in accordance with plumbing and building codes having jurisdiction.

B. PVC pipe, fittings, or similar un-rated material shall not be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure.

C. Provide water pressure regulating valves:

1. At the service entry where incoming water supply pressure is greater than 70 psi.
2. Anywhere else in the distribution system where delivered water pressure is excessive relative to the fixture or equipment it serves, based on the fixture or equipment manufacturer's recommendations. Examples may include dish machines, booster heaters, food waste disposers, etc.

PART 2 - PRODUCTS

2.1 SANITARY SOIL, WASTE AND VENT PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.2 SANITARY SOIL, WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, clear, medium bodied, for sizes 3" and smaller and gray, heavy bodied, for sizes 4" and larger. Mating surfaces shall be prepared with ASTM F656 purple primer immediately prior to cement application.

2.3 GREASE WASTE AND VENT PIPING, WITHIN BUILDING AND BURIED

A. This Article applies to piping in the kitchen area(s) within the building and also to the piping outside the building limits which connects to the grease trap inlet.

B. CPVC Pipe and Fittings: All system pipe and fittings shall be from a single manufacturer, Schedule 40 CPVC manufactured of material in conformance with ASTM D1784 and in produced in accordance with ASTM F2618 from CPVC Type IV, ASTM Cell Classification 23447.

1. All pipe shall meet the dimensional requirements of ASTM F441/F441M and all pipe markings shall be accompanied by a yellow stripe for ease of identification.
2. All fittings shall be drainage pattern meeting the requirements of ASTM D3311 and specialty patterns according to the manufacturer’s specifications.

3. All pipe and fittings shall conform to NSF 14.
4. Joining shall be by solvent cement welding, using “one step” primer-less type CPVC cement specially formulated and manufactured in accordance with ASTM F493. Only cement from the system manufacturer shall be acceptable.
5. Mechanical connections for transition to other system materials shall be as specified by the pipe system manufacturer.
6. All installation shall be in accordance with the manufacturer’s instructions and applicable codes.
7. Acceptable Manufacturer: Spears Manufacturing Company Lab Waste CPVC Drainage System only.

2.4 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING, NOT BURIED

A. Cast Iron Pipe: CISPI 301 or ASTM A888, hubless.

1. Fittings: Cast iron, CISPI 301 or ASTM A888 drainage pattern.
2. Acceptable manufacturers (all pipe and fittings shall be from a single manufacturer):
   a. Tyler Pipe
   b. Charlotte Pipe
   c. AB&I Foundry
3. Joints: No hub, ASTM C564 neoprene gaskets with ASTM C1540 heavy duty wide bodied stainless steel clamp and solid shield assembly constructed of type 300 series stainless steel. Couplings shall have four clamps for pipe sizes up to and including 4” and shall have six clamps for pipe sizes larger than 4”. Clamp assemblies shall conform to FM 1680 Class 1 where required by the administrative authority. Torque all clamps per manufacturer’s recommendations.

B. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall.

1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

C. Copper Tubing: ASTM B306, DWV, for sizes 2" and smaller.

1. Fittings: ASME B16.23 cast copper alloy solder joint drainage fittings (DWV), or ASME B16.29, wrought copper and wrought copper alloy solder joint drainage fittings (DWV).
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead).
3. Joints between copper and cast iron pipe shall be made by way of copper soldered to a brass ferrule and the ferrule joined to the cast iron hub by a compression or caulked joint.

D. Brass Pipe: ASTM B43, chrome plated

1. Fittings: ASME B16.23 cast bronze, chrome plated.
2. Joints: In accordance with ASTM B828 using ASTM B32 Alloy Grade Sn 50 solder (50-50 tin-lead) or as recommended by the manufacturer.
3. Applies to exposed piping applications (such as kitchens), wherever required by the prevailing code or by the Authority Having Jurisdiction.

E. Galvanized Steel Pipe: ASTM A53/A53M, schedule 40.

1. Fittings: ASME B16.3, ASTM A153/A153M hot-dip galvanized, ASTM A197/A197M malleable iron, minimum pressure class 150.
2. Joints: Threaded joints in accordance with the manufacturer's installation instructions and ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads and shall be approved, insoluble in water, and non-toxic.
3. Applies only to limited installations such as services from submersible pumps and ejectors.

2.5 STORM DRAINAGE PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.6 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.7 STORM DRAINAGE PIPING, WITHIN BUILDING, NOT BURIED

A. Cast Iron Pipe: CISPI 310 or ASTM A888, hubless.

1. Fittings: Cast iron, CISPI 310 or ASTM A888 drainage pattern.
2. Acceptable manufacturers (all pipe and fittings shall be from a single manufacturer):
   a. Tyler Pipe
   b. Charlotte Pipe
   c. AB&I Foundry

3. Joints: No hub, ASTM C564 neoprene gaskets with ASTM C1540 wide bodied stainless steel clamp and solid shield assembly constructed of type 300 series stainless steel. Couplings shall have four clamps for pipe sizes up to and including 4" and shall have six clamps for pipe sizes larger than 4". Clamp assemblies shall conform to FM 1680 Class 1 where required by the administrative authority. Torque all clamps per manufacturer's recommendations.

2.8 SUB-SURFACE DRAINAGE PIPING SYSTEM

A. PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall.

1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

B. Perforations

1. Piping shall be provided with perforations direct from the manufacturer, from a fabrication shop, or on the job site.
2. Piping shall be uniformly perforated, with two rows of 5/8 inch diameter holes. Holes shall be located 120 degrees apart from the center line of the pipe and spaced 5 inches apart along the length of the pipe.

C. Filter Fabric

1. A suitable geotextile filter fabric (Mifafi 140N or equivalent) meeting ASTM D6707/D6707M shall be provided in accordance with the manufacturer's requirements and consistent with the recommendations of the project geotechnical report.
2. All perforated pipe and the associated fittings shall be wrapped with filter fabric.

2.9 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

A. Copper Tubing: ASTM B88, Type K, hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASME B16.22 wrought copper alloy solder joint pressure fittings.
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.
3. Provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, for all buried piping. Chase Construction Products Tapecoat H35 or approved equivalent.

B. Ductile Iron Pipe: Minimum pressure class 150, AWWA C151/A21.51

1. Fittings: Standard ductile iron or gray iron, AWWA C110/A21.10.
2. Joints: Rubber-gasketed push-on joints, AWWA C111/A21.11. Installation shall be in accordance with AWWA C600.

3. Provide continuous polyethylene encasement for all piping in accordance with AWWA C105/A21.5.

C. PVC Pipe: AWWA C900 PVC pressure pipe for potable water, UL 1285. Minimum pressure class 150. Gasketed integral bell type.

1. Fittings and Joints: ASTM D1784 PVC gasketed bell fittings for AWWA C900 pipe. Gaskets shall conform to ASTM F477.
2. Joints shall conform to ASTM D3139.

D. PVC Pipe: ASTM D1785, NSF 61 schedule 80 system, the product of a single manufacturer.

1. Fittings: ASTM D2464 / ASTM D2467 schedule 80 PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

E. PVC Pipe: ASTM D1785, NSF 61 schedule 40 system, the product of a single manufacturer.

1. Fittings: ASTM D2466 schedule 40 PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

F. PVC Pipe: ASTM D2241, NSF 61, not to exceed SDR-26, and with no less than a 150 psi pressure rating, the system shall be the product of a single manufacturer.

1. Fittings: ASTM D2466 PVC.
2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.10 DOMESTIC WATER PIPE, BURIED WITHIN 5 FEET OF BUILDING EDGE

A. Copper Tubing: ASTM B88, Type K. Provide soft annealed for pipe sizes up to and including 2" and hard drawn for sizes 2-1/2” and larger.

1. Fittings: ASME B16.22 wrought copper pressure fittings.
2. Joints shall be as follows:
   a. No joints shall be permitted for pipe sizes 2” and smaller. All such piping must be run continuous where buried and brought up to no less than 12” above the finished floor before any joint is provided.
   b. For sizes larger than 2”, joints between copper pipe and fittings shall be brazed and shall be made in accordance with all the applicable portions of ASTM B828, manufacturer’s recommendations, and AWS requirements. Brazing filler metal shall be in accordance with AWS A5.8/A5.8M and any required flux shall meet AWS A5.31M/A5.31, Type FB3-A or FB3-C.
3. Beginning at no closer than the 5’-0” mark from the building, all piping buried or in contact with concrete shall be provided with one of the following, which shall also extend to a minimum of 6” above the finished floor:
   a. AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer’s installation guidelines. Chase Construction Products Tapecoat H35 or approved equivalent.

b. Continuous polyethylene lining, minimum 60 mil nominal thickness.

B. Stainless Steel Pre-Fabricated In-Building Riser (acceptable for sizes 2” through 10”)

1. Corrosion resistant Type 304 stainless steel construction single, extended 90 degree fitting.
2. UL listed, FM approved and NFPA 24 compliant.
3. Lead free and NSF 61 / NSF 372 certified.
4. Acceptable manufacturers:
   a. Ames Fire & Waterworks Series IBR (4” through 10”) and IBR2 (2”, 2-1/2”, and 3”)
   b. Zurn Wilkins Model WBR (4” through 10”)
5. For sizes 3" and smaller, ensure to provide riser with an (inlet) end connection type as appropriate for the site water service pipe material. Provide an adapter fitting at each end of the riser if/as necessary. All such fittings shall be approved for installation with the piping material being installed, code accepted, and NSF 61 compliant.
6. Note: For this application, the inlet joint for larger diameter (4” through 10”) piping (which shall not be located below a building slab or foundation) can be rubber gasketed push-on type, ANSI/AWWA C111/A21.11. Installation shall be in accordance with AWWA C600.
7. Provide continuous polyethylene encasement for all piping buried or in contact with concrete in accordance with AWWA C105/A21.5, beginning at no closer than the 5’-0” mark from the building and to a minimum of 6” above the finished floor.

2.11 DOMESTIC WATER PIPING, WITHIN BUILDING, BURIED

A. Copper Tubing: ASTM B88, Type K, soft annealed.

1. No joints allowed buried, run tubing continuous.
2. Provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer’s installation guidelines, for all piping buried or in contact with concrete, to a minimum of 6" above finished floor. Chase Construction Products Tapecoat H35 or approved equivalent.
3. Applies to installations including services to island sinks and trap primer lines.

2.12 DOMESTIC WATER PIPING, WITHIN BUILDING, NOT BURIED

A. Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast bronze or ASME B16.22 wrought copper alloy solder joint pressure fittings.
2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.

3. Fittings and joints for pipe sizes 1/2" through 4” may be mechanical press-connect system joints with ASME B16.51 lead-free copper bodied fittings with integral ethylene-propylene diene monomer rubber (EPDM) sealing gaskets. All fittings, couplings, and adapters shall be the product of a single system manufacturer and only that manufacturer’s approved press tools, kits, and jaws shall be used.
   a. EPDM o-rings shall be pre-installed and lubricated with NSF 61 listed lubricant.
   b. All installers of copper press-connect fittings shall be trained by the fitting manufacturer’s appointed representative and carry such credentials for the duration of the project.
   c. The fitting manufacturer’s representative shall conduct periodic inspections of the installation and shall provide written reports of such inspections to the Contractor and Engineer, including any observed deviations from the manufacturer’s recommended installation practices.
4. Rolled groove type fittings and joints shall be acceptable for copper pipe sizes 2-1/2 inch and larger, with all tools, couplings, adapters, fittings, and gaskets the product of a single system manufacturer.
   a. Fittings shall be cast bronze using lead-free alloys per ASTM B584 or copper wrought copper constructed to ASTM B75/B75M, compliant with NSF 61 for potable water service applications, and meet ASTM F1548.
   b. Couplings shall be epoxy/enamel (rust-inhibiting) coated ductile iron housings conforming to ASTM A536.
   c. Gaskets shall be EPDM for potable water, meeting ASTM F1476, and NSF 61 / NSF 372 certified for potable water service from 30 degrees to 180 degrees F.
   d. Acceptable system manufacturers: Victaulic, Anvil Gruvlok, Shurjoint.

2.13 DOMESTIC WATER PIPING, WITHIN BUILDING - SPECIAL APPLICATIONS

A. For filtered and/or reverse osmosis conditioned water applications such as commercial kitchen, break room, and central drinking water treatment systems, copper water piping shall not be employed for post-system distribution unless specifically noted otherwise.

B. For such special applications, provide approved plastic pipe and fittings consistent with the treatment system manufacturer's recommendations, the particular installation setting (buried or not buried, return air plenum or non-plenum space, etc.) and local AHJ requirements.

C. For applications, pressures, and temperatures consistent with the piping manufacturer's recommendations, Uponor PEX-A pipe and fittings (straight lengths for sizes 1" and larger, coiled form for sizes 3/4" and smaller), complete with insulation and supports as required, is preferred.

2.14 ADAPTERS, TRANSITIONS, UNIONS, COUPLINGS, FLANGES, CONNECTORS

A. (Non-Acid Waste) Drainage Applications:

1. Provide approved listed adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements.

2. For dissimilar piping above ground, provide stainless steel shielded, molded elastomeric couplings and adapters meeting ASTM C564 and ASTM C1460. Applies to installations including cast iron to PVC transitions immediately adjacent to the building floor where piping below is buried.
3. For dissimilar buried piping not below building slab, provide shear resistant .012" thick 300 series stainless steel shielded, PVC gasketed flexible couplings and adapters meeting ASTM D5926 and ASTM C1173. For direct-bury applications, provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, to completely wrap the shield, banding, and screws. Chase Construction Products Tapecoat H35 or approved equivalent.
4. Acceptable manufacturers:
   a. Anaco-Husky/Cremco
   b. Mission Rubber Company LLC
   c. Fernco, Inc.
   d. Fernco, Inc. Strong Back RC 1000 Series (buried piping beyond limits of building; or readily accessible buried piping transitions in backwater valve pits, etc.)
5. Adapters, couplings, bushings for copper DWV pipe shall be cast bronze or wrought copper, ASME B16.23 / ASME B16.29.

B. Domestic Water Applications:

1. Provide joints between various materials with approved adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements and the manufacturer's instructions.
2. For copper tube and pipe: adapters, bushings, plugs, caps, and couplings shall be wrought copper or cast bronze; flanges (minimum class 150) and unions shall be cast bronze. Provide with solder or threaded connections as necessary and as produced to applicable standards ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.24, ASME B16.50 ASME B16.50, ASME B1.20.1. All such appurtenances shall be for use in above ground potable water systems.
3. Buried to not buried transitions for water service entries:
   a. 100% fusion bonded epoxy coated ASTM A536 cast ductile iron construction coupling with acrylonitrile butadiene rubber (NBR) gaskets and EPDM insulating boot for water service. 5/8 inch high strength stainless steel bolts and nuts. Coupling shall meet AWWA C219. Romac Industries, Inc. IC501 or pre-approved equivalent.
   b. 100% fusion bonded 14 mil epoxy coated coupling with ASTM A536 cast ductile iron rings. Complete with acrylonitrile butadiene rubber (NBR) gaskets and type 304 stainless steel bridge, spacers, nuts, and bolts. Coupling shall meet AWWA C219, NSF 61, and NSF 372. Krausz USA Hymax Grip Coupling Restraint or pre-approved equivalent.
4. Dielectric connections:
   a. For pipe sizes 2 inch and smaller, provide lead-free dielectric unions, rated to 180 F at 250 psi and compliant to ASSE 1079.
   b. For pipe sizes larger than 2 inches, provide lead-free dielectric flanged pipe fittings, rated to 180 F at 175 psi and meeting ASME B16.1.

c. For grooved copper joining systems, provide grooved end dielectric transition fitting from system manufacturer, with virgin polypropylene internal lining, meeting NSF 61.

C. General:

1. Unions for ferrous pipe shall be ASME B16.39 galvanized malleable iron, threaded, minimum pressure class 150.
2. Plugs and bushings for ferrous pipe shall be ASME B16.14 galvanized malleable iron, threaded.
3. Nipples for ferrous pipe shall be schedule 40, galvanized, ASTM A53/A53M welded steel pipe nipples, threaded, meeting ASTM A733.
4. Couplings for ferrous pipe shall be galvanized steel, threaded, manufactured in accordance with ASTM A865/A865M.
5. Flanges for ferrous pipe shall be galvanized forged steel construction, either socket weld or slip-on weld type, minimum pressure class 150, manufactured to ASME B16.5.
6. Bolts, nuts, and gaskets for flanged connections shall be appropriate to the pipe material, fluid type, temperature, and pressure. 1/16” thick pre-formed neoprene, typical.
7. Provide flexible stainless steel connectors at pumps and other such equipment, in accordance with manufacturer’s recommendations. Connectors shall have corrugated hose and braided 300 series stainless steel jacketing. Carbon steel flanged or grooved ends as appropriate. NSF 372 lead-free for all potable water applications. Metraflex Company or pre-approved equivalent.

2.15 GATE VALVES (IRON)

A. ASTM A126 cast iron bodied, class 125 gate valve with bolted bonnet, non-rising ASTM B16/B16M brass stem and packing gland, solid wedge, cast iron hand-wheel. Bronze wedge for sizes up through 6” and cast iron wedge with bronze bushing and wedge face rings for sizes 8” and larger.

B. Basis of design:

1. NIBCO T-619 (threaded) for sizes 2” through 4”.
2. NIBCO F-619 (flanged) for sizes 6” and larger.

C. Acceptable alternate manufacturers:

1. Apollo
2. Milwaukee

D. Applies only to limited installations such as services from submersible pumps and ejectors. Not to be used for domestic water systems.

2.16 GATE VALVES (DUCTILE IRON)

A. Fusion bonded epoxy coated ASTM A536 ductile iron bodied, class 125 gate valve with bolted bonnet, non-rising Type 304 stainless steel stem, resilient wedge. End connections as suited for adjacent piping. Provide with square operating nut for extended handle operation or with hand-wheel as appropriate for depth of burial and access. Certified lead-free to NSF 61 / NSF 372 and AWWA C509 & AWWA C515 compliant (3" and larger).

B. Basis of design:

1. NIBCO 619 series for sizes 2" through 12".

C. Applies to outdoor, buried domestic water main installations beyond 5 feet from the building edge. Not to be used inside of buildings.

2.17 BALL VALVES

A. All bronze cast construction two-piece 600 psi body, blow-out proof stem, Teflon seated, lead-free, with stainless steel trim (including ball, stem, and valve handle). Threaded connections. Certified lead-free to NSF 61 / NSF 372 and suited to 180 degrees F.

B. Basis of design (bronze valves):

1. NIBCO T-585-66-LF (full port) for all sizes up through 2".
2. NIBCO T-580-66-LF (conventional port) for sizes 2-1/2" and 3".

C. Valves 4" and larger shall be split body stainless steel construction, 275 psi cold working pressure, blow-out proof stem, PTFE seated, type 316 stainless steel trimmed, class 150, full port design with manual gear operator. NIBCO F-515-S6-F-66-FS.

D. Acceptable alternate manufacturers:

1. Apollo 77 CLF-A series (full port) for all sizes up through 2".
2. Milwaukee UPBA-400S (full port) for all sizes up through 2".
3. Apollo 77 CLF-A series (full port) for size 2-1/2" and Apollo 70LF-140 series (standard port) for 3".
4. Milwaukee UPBA-100S (standard port) for sizes 2-1/2" and 3".

E. Applies to domestic water system installations.

F. Provide valves complete with extended lever handles as required to accommodate insulation and full valve operation.

G. Provide valves complete with memory stop kit where used for balancing applications.

2.18 BUTTERFLY VALVES

A. ASTM A536 ductile iron bodied, (minimum) 200 psi lug type wafer style butterfly valve with ASTM A564 Type 316 series stainless steel stem, ASTM A743 stainless steel disc, and EPDM rubber seat/lining. Extended neck. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

B. Basis of design:

1. NIBCO LD-2000-3 (lever handle operated) for sizes 2-1/2” through 4”.
2. NIBCO LD-2000-5 (manual gear operated) for sizes 6” and larger.
3. Install between standard ASME (minimum) class 125 flanges in accordance with manufacturer’s recommendations.

C. Acceptable alternate manufacturers:

1. Apollo
2. Milwaukee ML234E (lever handle operated) and ML334E (manual gear operated).

D. Applies to domestic water system installations.

2.19 BUTTERFLY VALVES (GROOVED)

A. Grooved end, lead-free, copper alloy bodied, 300 psi butterfly valve with EPDM encapsulated ductile iron or aluminum bronze disc, EPDM seat/seal, stainless steel stem and trim, and extended neck. ANSI/NSF 61 certified for potable water systems. Lever handle operated for sizes 2-1/2” through 4” and manual gear operated with handwheel for sizes 6” and larger.

B. Acceptable manufacturers:

1. Victaulic 608N (cast brass body with aluminum bronze construction disc).
2. Grinnell B680 (ASTM B584 bronze bodied).
3. Anvil Gruvlok Series 6700 CTS (ASTM B584 bronze bodied).

C. Applies only to domestic water system installations employing grooved copper joining systems, as specified elsewhere in this section. Manufacturers shall only be acceptable where their grooved systems are provided.

2.20 CHECK VALVES (BRONZE)

A. ASTM B62 / ASTM B584 bronze body and disc, minimum 200 psi (cold working pressure) Y-pattern horizontal swing type check valve with removable bronze bonnet, Type 300 series stainless steel nuts and hinge pin, and PTFE disc seat. Threaded connections. Certified lead-free to NSF 61 / NSF 372 and suited to 180 degrees F.

B. ASTM A126 cast iron bodied, (minimum) class 125 globe style spring loaded (silent) check valve with ASTM B584 bronze disc and seat. Flanged connections. Certified lead-free to NSF 61 / NSF 372 and suited to 200 degrees F.

C. Basis of design:

1. NIBCO T-413-Y-LF (Y-pattern swing type) for sizes up through 2”.
2. NIBCO F-910-B-LF (globe style spring loaded type) for sizes 2-1/2” and larger.

D. Acceptable alternate manufacturers:

1. Apollo (for sizes up through 2”)

E. Applies to domestic water system installations including associated pump discharge lines. Valves shall be suited for installation in both horizontal lines and vertical lines with upward flow, in accordance with manufacturer's recommendations.

2.21 CHECK VALVES (IRON)

A. ASTM A126 cast iron bodied, (minimum) class 125 conventional horizontal swing type check valve with bronze, cast or ductile iron disc. 200 psi cold working pressure. Threaded or flanged connections.

B. Basis of design:

1. NIBCO T-918-B (threaded connections) for sizes 2" through 4".
2. NIBCO F-918-B (flanged connections) for sizes 6" and larger.

C. Acceptable alternate manufacturers:

1. Apollo (flanged in all sizes)
2. Milwaukee F-2974A (flanged in all sizes)

D. Applies only to limited installations such as services from submersible pumps and ejectors. Not to be used for domestic water systems.

2.22 PRESSURE REGULATING VALVES (PRV'S)

A. ASTM B62 / ASTM B584 bronze bodied direct acting, ASSE 1003 single diaphragm type pressure regulating valve with removable bronze bonnet, in-line stainless steel strainer and spring, and FDA approved EPDM seat disc and Buna-N diaphragm. Threaded connections. Certified lead-free to NSF 61 / NSF 372 and suited to 180 degrees F.

B. NSF 61 epoxy coated ductile iron bodied pilot-operated globe style pressure regulating valve assembly. Complete with low-flow bypass and stainless steel, bronze, and copper trim and fittings. NSF 61 EPDM seat disc and diaphragm. Threaded or flanged connections. Suited to 180 degrees F.

C. Basis of design:

1. Apollo PRH-LF (36HLF series) for direct acting valves, sizes up through 3". Provide with y-strainer. Provide threaded up through 2" and flanged for larger sizes.
2. Apollo A127-LF series for pilot operated valves, sizes 1-1/4" through 4".

D. Acceptable alternate manufacturers:

1. Cla-Val
2. Victaulic (pilot-operated valves)

E. PRV’s shall automatically reduce inlet pressure to a steady lower downstream pressure, regardless of changing flow rate. Provide complete with inlet strainer, inlet and outlet pressure gauges, isolation valves, and unions. Provide bypass line around assembly with normally closed valve.

F. Point of use PRV's serving individual equipment items shall not be required to have a bypass.

2.23 BALANCING VALVES

A. Self-contained, fully automatic thermally actuated balancing valve shall continuously adjust flow to maintain the desired domestic hot water temperature within the branch line, regardless of system operating pressure. Valve shall modulate between open and closed position within a 10 degrees F range. The valve set-point (closing temperature) shall be the hot water system supply temperature. Valve body and all internal components shall be constructed of stainless steel with major components constructed of Type 303 stainless. Rated for 200 psi maximum working pressure and no less than 250 degrees F maximum working temperature. Lead-free NSF 372 and NSF 61 compliant. Threaded connections.

B. Basis of design:

1. ThermOmegaTech Circuit Solver, sizes 1/2" through 2”. Provide a union and ball type shutoff valve on both sides of the balancing valve.
2. ThermOmegaTech Circuit Solver with integrated union (CSU) assembly, sizes 1/2" and 3/4". Balancing valve assembly shall come complete with union body and ball type shutoff valves on both sides.
3. Provide complete with an integral check valve from the manufacturer, positioned after the balancing valve. For balancing valves not available with an integral check valve as part of the manufacturer's assembly, ensure to provide a lead-free swing type check valve on the downstream side of the balancing valve component.

C. Applies to circulated domestic hot water system installations including multi-branch parallel piping circuits and single-loop piping circuits.

1. Provide balancing valve at end of each domestic hot water supply line (after last fixture served) just prior to the hot water return line, as indicated on Drawings and in accordance with manufacturer’s installation recommendations.
2. Provide a pipe tee or elbow with bushing as appropriate, 3/4" threaded thermowell, and bi-metal adjustable angle 3 inch dial thermometer upstream of each balancing valve. Thermowell stem length and thermometer temperature probe length to be suited for pipe size, insulation thickness, and to ensure clearance for maintenance access and easy viewing of thermometer. Trerice bimetal/sensor, threaded-stepped shank thermowell (style 76) of lead-free brass (PBF) material. Trerice Model B836 thermometer with 300 stainless steel case and stem, hermetically sealed, double strength glass windowed, aluminum white-faced dial, complete with external reset and 0 to 200 degrees F range. Thermowell and thermometer face to be oriented upright for readability.

PART 3 - EXECUTION

3.1 EXCAVATION, BEDDING AND BACKFILL

A. This section shall apply for the excavation, bedding, and backfill of all buried piping unless specifically noted otherwise. All work shall be coordinated with any job site subsurface drainage/dewatering and adjusted accordingly.

B. Establish elevations of buried piping outside the building to ensure the following:

1. Not less than 2 feet of cover, or not less than maximum depth of frost penetration, whichever is the greater.
2. For water lines intended for fire protection service, the depth of cover shall be:
   a. Not less than 2'-6" in those locations where frost is not a factor.
   b. Not less than 1'-0" below the frost line for the locality.
   c. Not less than 3'-0" for piping under driveways.
   d. Not less than 1'-0" below the bottom of the building foundation/footers.
   e. In full compliance with the requirements of NFPA 13 and NFPA 24.

C. Excavation:

1. Excavate trenches for underground piping to the required depths.
2. The bottom of the trench or excavation shall be cut to a uniform grade.
3. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp to existing density.
4. Coordinate alignment of pipe trenches to avoid obstructions. Ensure that proposed routing of pipe will not interfere with building foundation before any trenching has begun. Should conflicts occur, contact Architect/Engineer before proceeding.
5. Should any sleeving of the building foundation be required, this shall be provided as directed by the structural engineer of record AND in accordance with the prevailing code, but in no case shall the sleeve be any less than two (2) pipe sizes greater than the pipe it serves.

D. Bedding and Backfill:

1. Backfill shall not be placed until the piping has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades indicated on drawings. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe. Provide select fill up to finished surface or grade, unless indicated otherwise by project geotechnical report or specified otherwise in Division 02.
2. Compacting Backfill: Place material in uniform layers of 8 inches maximum, loose measure and compact to not less than 95% of maximum soil density as determined by ASTM D698 Standard Proctor.
3. Restoration: Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks and similar areas, to a condition equal to the adjacent undisturbed earth and restore surface of the area to the condition existing prior to trenching or excavating operation.

4. A clay fill "trench plug" extending 3 feet inside the building line and 5 feet outside the building line shall be placed to completely surround utility lines passing beneath the foundation and grade beam. The materials shall consist of on-site soils with a plasticity index (PI) between 30 and 40 percent compacted to at least 95 percent of the Standard Proctor and maximum dry density as determined by ASTM D698.

E. Cement Stabilized Sand:

1. Materials:
   a. Cement shall be Type I Portland cement conforming to ASTM C150/C150M.
   b. Sand shall be clean, durable sand meeting grading requirements for fine aggregates of ASTM C33/C33M and free of organic matter and deleterious substances.
   c. Water shall be potable and free of oils, acids, alkalis, organic matter, or other deleterious substances, meeting requirements of ASTM C94/C94M.
2. Mixture:
   a. Product shall consist of not less than 1.5 sacks of Portland cement per ton of dry sand.
   b. Mixture shall contain sufficient water to hydrate the cement and be thoroughly mixed in a pugmill type mixer.

F. For water lines (including In-Building Risers) intended for fire protection service, provide joint restraints by way of concrete thrust blocks in accordance with the requirements of NFPA 13 and NFPA 24.

G. Aggressive Soil Conditions: Soil shall be considered aggressive and protection of buried metallic piping shall be provided as specified if any of the following situations exist:

1. Conditions are identified as such by the project geotechnical report or project geotechnical engineer.
2. The soil environment is a landfill area, swamp, marsh, polluted river bottom, cinder bed, or has alkaline soils.
3. A score of ten or higher is tallied when applying the soil assessment tool detailed in Appendix A of AWWA C105/A21.5. An excerpt of this evaluation procedure is provided below for reference but is not intended as a substitute for the complete and latest Standard:

NUMERICAL CORROSIVITY SCALE	
Soil Parameter	**Assigned Points**
Resistivity (ohm-cm)	
< 700	10
700 - 1,000	8
1,000 - 1,200	5
1,200 - 1,500	2
1,500 - 2,000	1
> 2,000	0
pH	
0 - 2	5
2 - 4	3
4 - 6.5	0
6.5 - 7.5	0
7.5 - 8.5	0
> 8.5	3
Redox Potential (mV)	
> 100	0
50 - 100	3.5
0 - 50	4
< 0	5
Sulfides	
Positive	3.5
Trace	2
Negative	0
Moisture	
Poor drainage continuously wet	2
Fair drainage generally moist	1
Good drainage generally dry	0

H. Building Sub-Surface Drainage System Installation:

1. The following general installation provisions are intended to complement, not conflict with, the recommendations of the project geotechnical report. In the event of a conflict with or more stringent requirements in this report, it shall govern the installation of this system.
2. Such pipe shall be bedded and surrounded by filter material of suitable gradation. Refer to the recommendations of the project geotechnical report.

3. Drainage system shall be provided directly behind and at the bottom of buried walls, within granular drainage medium as specified and in accordance with the latest project geotechnical report.

I. Crawlspace Installations

1. Where piping will be installed in such spaces, its installation shall be fully coordinated with the building slab/floor construction and/or existing conditions.
2. Routing and installation shall be coordinated so that all piping is provided within the available clear space above the crawlspace “floor”, with uniform slope as required per code and/or as indicated on the Drawings.
3. Rods, hangers, inserts/anchors and hardware shall be provided to properly support the piping to prevent sagging, misalignment, stress on joints or fittings, and any deviation in required slope. Refer to other paragraphs in this Section for additional requirements for suspended pipe installation.
4. All rods, hangers, and hardware in crawlspaces shall be provided hot-dipped galvanized or stainless steel. Refer to Section 22 05 29 for additional information on Hanger and Supports.
5. All waste piping p-traps and all water piping located in such environments shall be insulated. Refer to Section 22 07 19 for additional information on Pipe Insulation.
6. **Unless specifically noted othwerwise, reference the Articles above addressing piping "NOT BURIED" for the pipe material to be provided within crawlspaces, for each plumbing system.**

J. Void Form/Carton Form/Void Box Installations

1. Where piping will be installed in a such a setting, steps shall be taken to isolate and protect the piping from expansive soil conditions. This work shall be fully coordinated with the building slab/floor construction, the project geotechnical report, and the structural Drawings and specifications. The most stringent conditions/recommendations shall govern.
2. All piping below slab shall be supported by an approved suspended system.
3. System structure:
   a. Shall provide a dimensionally stable underground void space that is independent from the overhead structural slab. The subterranean system shall support the weight of suspended lateral pipes and fittings, including all imposed loads, throughout the construction process.
   b. The system shall be designed to have the ability to temporarily position and suspend the lateral pipes and fittings to the required height/depth and slope until permanently anchored to the overhead structural slab via the securing hanger system. The open, underground system will then remain independent from the securing hangers.
   c. The open space of the system beneath the structural slab shall be designed to receive the infill of vertical expansion from the underlying soils. If vertical pressure is applied to the edges of the system in contact with the soil, the uplifting soil pressure will become separate and allow the lateral pipes and fittings to be totally independent from the system.
4. System components:
   a. The system shall have waterproof components related to its intended performance.

b. The system must maintain its structural integrity in all humid environments.
c. The system must have industry-proven performance in any and all inclement conditions.
d. The system shall be able to perform if and when submerged in water.
e. All independent components not included in the system shall comply with the project specifications in order to achieve the intended results of the designed system.
f. All vertical all-thread rod must have a component secured toward the top end and be permanently affixed into the concrete slab in order to maintain the required elevations.
g. All system components, excluding all-thread rod, nuts/washers, shall be furnished by the designed, system manufacturer.
h. Galvanized steel all thread-rod and hardware shall be provided and these materials shall be coordinated with the system manufacturer's related components.
i. The system shall be installed per the manufacturer's requirements and recommendations.

5. Submittals: The exact system to be provided, complete with dimensioned detailed drawings and material specifications, shall be submitted for review by the Architect, MEP engineer, structural engineer, and project geo-technical engineer.
6. Acceptable System Manufacturers:
   a. SuperVoid Systems, LLC
   b. Void Form Products, Inc.
   c. Other pre-approved system providers.
7. Manufacturer Training: The system manufacturer shall provide on-site training, support, and guidance to the Contractor regarding the recommended installation of their products.

K. Pipe Penetrations of Buried Exterior Walls or Foundations

1. Unless specifically indicated otherwise on the Drawings, each pipe penetration shall be provided with a schedule 40 steel pipe sleeve no less than two (2) pipe sizes larger than pipe itself.
2. At each penetration provide GPT Industries ("Thunderline") Link Seal Modular Seal LS series. The exact model shall be as required for the pipe material, pipe size, and sleeve length for the penetration. Provide complete with EPDM sealing element and model "C" zinc coated carbon steel hardware.

3.2 INSTALLATION

A. General requirements for piping:

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
2. Remove any scale, oil and dirt, on inside and outside, before assembly.
3. Prepare piping connections to equipment with flanges or unions.
4. Confirm pipe placement, depth/elevation, and flow lines prior to any installation.

B. General requirements for valves:

1. Install valves with stems upright or horizontal, not inverted.
2. Valves shall be line-sized unless specifically noted otherwise.
3. Provide clearance for installation of insulation and access to valves and operable fittings. Valves installed beyond reasonable reach shall be provided with a chain operator.
4. Provide access doors where valves and operable fittings are not otherwise accessible. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.
5. Gate valves installed buried shall be covered with an adjustable cast iron roadway box extended to grade. Cover shall be cast iron with 'water' cast on top of cover and shall be set flush to finished paving or 2" above finished earthen grade. Box shall be supported from undisturbed soil or concrete base and shall not introduce any stress to piping under all traffic conditions.

C. Install all materials in accordance with the manufacturer's published instructions.

D. All exposed sewer and water pipe in toilet rooms or other finished areas of the building shall be chrome plated.

E. Provide non-conducting dielectric connections wherever joining dissimilar metals.

F. Route piping in an orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on drawings, and maintain gradients.

G. Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

H. Group piping whenever practical at common elevations.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

K. Provide encasement for and support for utility meters in accordance with the requirements of utility companies.

L. Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

M. Maintain uniformity in the installation of piping materials and joining methods. Do not mix material types.

N. Where connecting new underground sanitary, storm, or vent piping to existing piping of dissimilar material, provide suitable mechanical transition fittings complete with corrosion protection for metallic elements. Chase Construction Products Tapecoat H35 or approved equivalent and a final coat of coal tar to completely cover the transition.

O. Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.

P. Waste nipple from wall to tapped tee shall be schedule 40 threaded galvanized steel pipe or brass or copper with threaded adapter.

Q. General requirements for cast iron piping installation:

1. Install all pipe and fittings in accordance with published recommendations from the manufacturer and the Cast Iron Soil Pipe Institute (CISPI). Specific items referenced below are not intended as a substitute for the complete and latest recommendations.
2. Install bell and spigot type pipe with bell end upstream.
3. Above ground horizontal pipe (suspended) shall:
   a. Be supported at no less than at every joint, and within 18” of the hub or coupling.
   b. Be maintained in alignment. Sagging or grade reversal shall be unacceptable.
   c. Be supported at terminal ends of all runs or branches and at each change of direction or alignment.
   d. Have all closet bends, traps, trap arms, and similar branches firmly secured.
   e. Be braced to prevent movement or joint separation.
   f. Be provided with suitable sway bracing (such as clamps, rods, and hardware) where pipe and fittings are suspended in excess of 18” by means of non-rigid hangers.
4. Above ground vertical pipe shall:
   a. Be secured at each stack base.
   b. Be secured at each floor and riser clamps shall be provided on no greater than 15’-0” intervals.
   c. Be adequately supported to keep the system (pipe and contents) in alignment.
5. Provide seismic restraints in seismically active areas, whether specifically required by the prevailing code or not.

R. For all buried non-metallic piping outside the building, provide minimum 14 AWG solid copper tracer wire (ASTM B1, ASTM B3) with high molecular weight polyethylene insulation (HMWPE) per ASTM D1248. Wire shall be suited for direct bury applications to facilitate the detection and tracing of underground piping systems. THHN wire and other such nylon jacketing shall not be allowed. Insulation color shall be provided per the particular utility, in accordance with the American Public Works Association (APWA) uniform color code. Provide corrosion proof wire connectors with twist locking design and protective dielectric sealant. Copperhead Industries, LLC Snakebite or pre-approved equivalent. Tracer wire shall be placed in the same orientation as the installed pipe and laid six inches directly above the piping. One end of the tracer wire shall be brought aboveground at a building wall or riser for easy identification.

S. PVC pipe, fittings, or similar un-rated material shall not be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure.

T. Installations of buried thermoplastic piping systems shall be in strict conformity with the manufacturer’s published instructions and the requirements of ASTM D2321 (gravity pipe) and ASTM D2774 (pressure pipe).

U. Installation of thermoplastic piping systems which are not buried shall be in accordance with the manufacturer's recommendations. The specific items indicated below are not intended as a substitute for the complete and latest manufacturer's recommendations.

1. Hangers and supports shall not compress, distort, cut, or abrade the piping. Nor shall they force the pipe and fittings into position.
2. Piping shall be supported at intervals sufficiently close to maintain pipe alignment and to prevent any sagging or grade reversal. System maximum operating temperature will determine support spacing.
3. Piping shall be supported at all branch ends and at all changes of direction, as close as practical to the fitting to avoid introducing excessive torsional stresses into the system.
4. Directly support (or if need be, immediately adjacent to) concentrated loads in the system, such as valves and other appurtenances.
5. Allowances must be made for thermal expansion and contraction of the piping system where temperature fluctuations can reasonably be expected to produce such movement. Provide and place hangers accordingly so as not to restrict.
6. Plastic piping systems shall not be placed alongside steam or other high temperature pipe lines or other high temperature objects.
7. Drainage piping shall be supported at trap arms as close as possible to the trap and all closet bends shall be supported and braced.

V. Installation of solvent cement joints for PVC and CPVC piping shall be in strict conformity with the requirements of ASTM D2855 and manufacturer's published instructions.

W. Provide approved heavy duty transition coupling at each transition from cast iron pipenot buried to buried PVC pipe as specified elsewhere in this section. Transition shall be made as close as possible to the floor for sanitary DWV piping systems and at test tee "minimum 12 inches A.F.F." for storm drainage piping. Support vertical cast iron pipe from floor anchors using riser clamp and galvanized all thread rod as specified in Section 22 05 29.

X. All grooved system tools and components (couplings, adapters, fittings, gaskets, and specialties) shall be the product of a single domestic system manufacturer.

Y. Grooved pipe system manufacturer shall provide on-site training for contractor's field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products at no additional cost to the owner.

3.3 APPLICATION

A. Provide union downstream of all valves at equipment or apparatus connections.

B. Provide unions downstream of all threaded isolation valves in the domestic water system to facilitate any future valve replacement.

C. Provide male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections.

D. Provide approved isolation valves for shut-off and to isolate all equipment items and distinct parts of systems. Isolation valves shall be provided for both hot and cold water in locations including, but not necessarily limited to, the following:

1. At each floor for each domestic water tap branching off from a vertical riser.
2. At each domestic water branch line capped for future use.
3. At each restroom or restroom group.
4. At each hose bibb, wall hydrant, roof hydrant, hose reel, and trap primer device (except for flush valve or tailpiece type trap primer devices).
5. At each domestic water branch line within 24” of the corresponding main.
6. At each plumbing fixture not otherwise served by a localized fixture group isolation valve.

E. Each plumbing water rough-in stub out shall be fitted with a supply stop.

F. Valves installed in insulated piping shall be fitted with extended lever operators of sufficient length to raise handle above the insulation jacket material. Where valve is used for throttling service, the valve handle shall be equipped with adjustable memory stop device.

G. Provide non-slam type check valves on discharge lines from all water pumps. Install at a minimum length of 5 times the pipe diameter from the pump and in accordance with manufacturer’s installation recommendations.

3.4 ERECTION TOLERANCES

A. All gravity drainage lines in the building shall have 1/4 inch per foot fall where possible and not less than 1/8 inch per foot fall toward the main sewer. Pipe must be laid so that the slope will be uniform and continuous. Permission shall be secured from the Architect and Engineer before proceeding with any Work where existing conditions prevent the installation at the minimum grade specified.

B. All vent and branch vent pipes shall be graded and connected as to drip back by gravity to the drainage pipe it serves. A slope of 1 inch per 40 feet will suffice for this requirement, subject to the approval of the local Authority Having Jurisdiction.

C. Slope all horizontal water piping with uniform pitch of 1/8 inch per 10 feet to low points to allow for complete system drainage. For long runs, where constant pitch cannot be maintained, provide intermediate low points and rise up again from such locations. Slope horizontal branches back to mains or risers. Provide clearly identified supplementary drain valves where hose bibbs, hydrants, or sill cocks will not suffice for this requirement.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, all domestic water systems shall be complete, thoroughly flushed clean and free of all foreign matter or erection residue.

B. Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. On building side of the main shut off valve, provide a 3/4" connection through which chlorine can be introduced into the water piping

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, in sufficient quantity to obtain 50 to 80 mg/L residual free chlorine solution throughout the entire domestic water piping systems.

E. Bleed water from outlets as required to ensure complete distribution and test for disinfectant residual at a minimum 15 percent of total outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.6 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services connecting to existing building services or utility lines as shown on the drawings.

B. Before commencing work, field verify invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover as required.

C. Provide new domestic water service connecting to existing building services or utility lines as shown on plans. Assure connections are in compliance with requirements of the jurisdiction having authority.

D. Extension of services to the building shall be fabricated from the same materials as the utility service lines or those materials specified herein.

E. Should points of connection vary from those indicated on the drawings contractor shall properly allow for this in the actual connections field fabricated.

3.7 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out after completion of the installation.

B. This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned.

3.8 VIDEO INSPECTION AND DOCUMENTATION

A. It shall be the responsibility of the plumbing contractor to retain the services of a qualified, independent company (other than the installing plumbing contractor) with no less than ten (10) years of experience in digital video camera inspection/investigation of plumbing drainage waste and vent lines for commercial/institutional building projects.

B. The independent company shall perform a complete video camera inspection of all waste piping buried inside the building. This shall include sanitary waste and any specialty waste (grease waste, oily waste, etc.) systems and shall extend from the building all the way to any associated outdoor traps/interceptors.

C. The independent company shall create a permanent digital video record of their inspection with accompanying definitive identification (audio or visual) to indicate different systems and different areas of the systems inspected.

D. The independent company shall prepare a comprehensive written report including, but not necessarily limited to, the following:

1. Complete company contact information.
2. Project name and address.
3. Date(s), time(s), and conditions during the inspection(s).
4. Name(s) of the operator(s) performing the inspection(s).
5. A general summary of the inspection results.
6. A written description of any and all material and/or installation deficiencies or irregularities found, with accompanying pictorial documentation. This shall include conditions such as:
   a. Deformed or damaged piping
   b. Full or partial blockage of piping
   c. Deleterious material or debris within the piping
   d. Slope deficiencies (inadequate, inconsistent, or absent slope)
   e. Valleys or “dips” in the piping
   f. Improper fittings in the piping including reductions in pipe size in the direction of flow

E. The written report shall be submitted under this Section but separately from other submittals of this Section. This shall occur immediately prior to substantial completion.

F. The written report and the digital video record (DVD or USB flash drive) shall also be submitted as part of the Project Record Documents.

3.9 TESTING OF PLUMBING PIPING SYSTEMS

A. During the progress of the work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems testing shall be accomplished prior to the application of insulation.

D. All piping systems shall be tested and proved absolutely tight for a period of not less than 24 hours. Tests shall be witnessed by the Architect or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

G. Domestic Water: Pressure test at one and one half times the normal working pressure or 125 psig, whichever is the greater, for 24 hours.

H. Sanitary Soil, Waste and Vents and Storm Sewer:

1. After the rough-in soil, waste and vent and other parts of the sanitary sewer including branch laterals have been set from the lowest level, at point of connection to existing utility lines, to above the floor line, all outlets shall be temporarily plugged or capped, except as are required for testing as described herein. Ground work shall not permit the backfill of trenches to cover any joints until the completion of testing. Back fill shall be limited to mid sections of full joints of piping only. For pipe in ground the piping shall be readied as described herein and filled with water to a verifiable and visible level to 10' above the lowest portions of the system being tested.
2. On multi-level buildings only one floor level shall be tested at a time. Each floor shall be tested from a level below the structure of the floor, or the outlet of the building in the case of the lowest level, to a level of 12 inches above the floor immediately above the floor being tested, or the top of the highest vent in the case of the highest building level. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 24 hours. If after 24 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 24 hour retention period, there shall be no perceptible lowering of the water level in the system being tested.

3. Should the completion of these tests leave any reasonable question or doubt of the integrity of the installation, additional tests including peppermint smoke, or other measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

3.10 COMPLETE FUNCTIONING OF WORK

A. All work reasonably implied as essential to the complete functioning of the systems shown on the Drawings and Specification shall be completed as part of the work of this Division, unless specifically stated otherwise. It is the intention of the Drawings and Specification to establish the type and function of systems but not to set forth each item essential to the functioning of any system. In case of doubt as to the work intended or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for Supplementary Instructions and Drawings, etc.

END OF SECTION

SECTION 22 11 12

DOMESTIC WATER PIPING - CROSS-LINKED POLYETHYLENE (PEX)

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the piping covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Pipe and pipe fittings.
2. Transition fittings.

C. The pipe, fittings, and appurtenances described herein shall be acceptable only where meeting all the requirements indicated below:

1. Where acceptable to the local authority having jurisdiction (AHJ).
2. Where suitable for use according to the manufacturer's recommendations and instructions.
3. For domestic water distribution where system pressure is 80 psig or less and system temperature is 140 degrees F or less.
4. For domestic hot and cold water piping which does not penetrate any fire-rated floors.
5. For above slab (not buried) domestic hot and cold water main and branch lines in sizes 3" and smaller, excluding installations prohibited below in Article 3.3 Installation and excluding final stubouts to fixtures and equipment, which shall be Type L copper with solder joint fittings.

1.3 RELATED WORK

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment

D. Section 22 07 19 - Plumbing Piping Insulation

E. Section 22 10 00 - Plumbing Piping

F. Section 22 11 19 - Plumbing Specialties

G. Section 22 30 00 - Plumbing Equipment

H. Section 22 40 00 - Plumbing Fixtures

1.4 REFERENCES

A. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.

B. ASTM D6394 - Standard Specification for Sulfone Plastics (SP).

C. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

D. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.

E. 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.

F. AWWA C651 - Disinfecting Water Mains.

G. ASTM International (ASTM):

1. ASTM D2765 - Standard Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics
2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
3. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials
4. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems

H. American Water Works Association (AWWA):

1. AWWA C904 - Cross-Linked Polyethylene (PEX) Pressure Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service

I. Canadian Standards Association (CSA)

1. CAN/CSA B137.5 Crosslinked Polyethylene (PEX) Tubing Systems for Pressure Applications

J. International Code Council (ICC)

1. International Plumbing Code (IPC)

K. International Association of Plumbing Officials (IAPMO)

1. Uniform Plumbing Code (UPC)

L. National Association of Plumbing, Heating and Cooling Contractors (NAPHCC)

1. National Standard Plumbing Code (NSPC)

M. Plastics Pipe Institute (PPI)

1. PPI Technical Report TR-4/06

N. Underwriters Laboratories (UL):

1. UL 263 - Standard for Fire Tests of Building Construction and Materials
2. UL 2846 - Safety Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics

O. Uponor, Inc.

1. Uponor Professional Plumbing Installation Guide (UPPIG), latest edition
2. Uponor Plumbing Design Assistance Manual (PDAM), latest edition

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Piping shall be labeled along entire length indicating size, class, material specification, manufacturer's name and country of origin.

C. Foreign pipe or fittings are unacceptable.

D. All installers must be trained and certified installers by the manufacturer, each with a current certification card.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data under provisions of Division One.

C. Include pipe materials, pipe fittings, transition fittings, supports/shields, and accessories. Provide manufacturer's catalog information, product certifications, and country of origin.

D. Prior to installation of pipe, submit drawings indicating where access panels will be located for valves, joints, and fittings located in inaccessible spaces.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience and must be a domestic manufacturer.

B. Installer: Company specializing in performing the work of this section with minimum 5 years documented experience on projects of similar size and complexity and with documentation proving successful completion of plumbing system installation and/or training by the PEX tubing manufacturer.

1.10 REGULATORY REQUIREMENTS

A. Perform work in accordance with plumbing and building codes having jurisdiction.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Comply with provisions of Division One.

B. Ordering: Comply with manufacturer`s ordering instructions and lead-time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer`s original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1. Store PEX tubing in cartons or under cover to avoid dirt or foreign material from entering the tubing.
2. Do not expose PEX tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover the tubing to prevent exposure to direct sunlight.

E. Damaged materials shall not be acceptable.

F. Protect piping systems from entry of foreign materials by providing temporary covers, completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.12 EXTRA MATERIALS

A. Furnish under provisions of Division One.

1.13 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: PEX-a manufacturer system warranty shall cover piping and fittings for a duration of 25 years from the date of installation. Piping system warranty shall apply to potable water distribution and water service systems constructed of pipe and fitting products sourced from the same manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Uponor, Inc.

2.2 PEX PIPE AND FITTINGS

A. PEX-a (Engel-Method Crosslinked Polyethylene) Piping: ASTM F876 and ASTM F877 (CAN/CSA-B137.5).

1. Provide in straight lengths for all sizes 1" through 3".
2. Coiled pipe is acceptable for sizes 3/4" and smaller.

B. PEX-a Fittings: elbows, adapters, couplings, plugs, tees and multi-port tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fitting manufactured from the following material types:

1. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX-a piping manufacturer and marked "F1960".
2. UNS No. C69300 Lead-free (LF) Brass.
3. 20% glass-filled polysulfone as specified in ASTM D6394.
4. Unreinforced polysulfone (group 01, class 1, grade 2) as specified in ASTM D6394.
5. Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D6394.
6. Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D6394.

C. Multi-Port Tees: Multiple-outlet fitting complying with ASTM F877 (CAN/CSA B137.5); with ASTM F1960 inlets and outlets.

1. Engineered polymer commercial branch multi-port tee.
2. Engineered polymer commercial branch multi-port elbow.
3. Engineered polymer commercial flow-through multi-port tee.

2.3 TRANSITION FITTINGS

A. PEX-to-Metal Transition Fittings:

1. Manufacturers: Provide fittings from the same manufacturer of the piping.
2. Threaded Brass to PEX-a Transition: one-piece brass fitting with male or female threaded adapter and ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
3. Brass Sweat to PEX-a Transition: one-piece brass fitting with sweat adapter and ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

4. PEX-a to Flange Transition: two-piece brass fitting with lead-free ProPEX adapter and steel flange conforming to ASME B16.5.

B. PEX-to-Thermoplastic Transition Fittings: CPVC to PEX-a Transition: Thermoplastic fitting with one spigot or socket end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

C. Provide appropriate transitions at all such locations.

2.4 VALVES

A. Refer to Section 22 10 00 for requirements for **all** ball valves. Provide adapters/transitions accordingly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify that site conditions are acceptable for installation of the domestic water piping. Do not proceed with installation until unacceptable conditions are corrected.

3.2 GENERAL PRACTICES

A. Install all materials in accordance with manufacturer's published instructions.

B. Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

C. Group piping whenever practical at common elevations.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Provide clearance for installation of insulation and access to valves and fittings.

F. Provide straight runs (no joints) of piping within inaccessible wall cavities.

G. Provide access doors where valves, joints, and fittings are not exposed in an accessible location. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.

H. Install valves with stems upright or horizontal, not inverted.

I. Install ball valves for shut-off and to isolate all equipment items, distinct parts of systems, or vertical risers.

J. Each plumbing fixture shall have a shut-off valve on each hot water and cold water supply line.

K. Each plumbing water rough-in stub out shall be fitted with a shut off valve.

L. Ball valves installed in insulated piping shall be fitted with extended lever operators of sufficient length to raise handle above the insulation jacket material. Where valve is used for throttling service valve handle shall be equipped with adjustable memory stop device.

M. Provide for complete system drainage. Slop horizontal piping uniformly to low points. Providing clearly identified supplementary drain valves where faucets, hose bibbs, hydrants, or sill cocks will not suffice for this requirement.

N. Provide water hammer arresters as indicated in Section 22 11 19.

3.3 INSTALLATION

A. Install plumbing system according to approved shop drawings and coordination drawings.

B. Comply with manufacturer`s latest product data, including product technical bulletins, installation instructions and design drawings, including the following.

C. Piping Installation:

1. Install PEX-a Pipe Support, arms and offsets in compliance with Chapter 5 - "System Design and Layout" in the Uponor Plumbing Design Assistance Manual (PDAM).
2. PEX shall not be installed in areas within five feet of UV light.
3. PEX shall not be installed within 6” of any gas appliance vents.
4. PEX shall not be installed within 12” of any recessed light fixture unless the piping is protected with suitable insulation or the fixture is insulation contact (I.C.) rated.
5. PEX shall not be installed between a tub/shower valve and tub/shower spout. Provide type L copper water tube for this application.
6. 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
7. All final stub-outs to plumbing fixtures and equipment shall be Type L copper with solder joint fittings.
8. Only approved and appropriate firestop materials shall be used with PEX piping.
9. When transitioning from PEX to other piping materials, follow the appropriate installation instructions for that product.
10. Install piping in full compliance with manufacturer`s Plumbing Installation Guide.

D. Hangers and Supports:

1. Horizontal PEX-a Piping Hangers: Install CTS hangers suitable for PEX-a piping in compliance with Chapter 6 - "Installation Methods" of the Uponor Plumbing Design Assistance Manual (PDAM) and local codes, with the following maximum spacing:

a. For IPC Jurisdictions: 3 inch and below: Maximum span, 32 inches.
b. For UPC Jurisdictions:1 inch and below: Maximum span, 32 inches.
c. For UPC Jurisdictions: 1-1/4 inch and above: Maximum span, 48 inches.
d. Note: The above maximum hanger spacing requirements may be extended with the use of a continuous support channel such as Uponor PEX-a Pipe Support.

2. Horizontal PEX-a Piping with PEX-a Pipe Channel: Install hangers for PEX-a piping with horizontal support channel in accordance with local jurisdiction and manufacturer`s recommendations, with the following maximum spacing:
   a. 3/4 inch and below: Maximum span, 6 feet.
   b. 1 inch and above: Maximum span, 8 feet.
3. Vertical PEX-a Piping: Support PEX-a piping with maximum spacing of 5 feet.

E. Pipe Joint Construction: PEX-a Connections: Install per manufacturer's recommendations. Use manufacturer-recommended cold-expansion tool for ASTM F1960 connections.

F. Field Quality Control: 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.

3.4 INSULATION

A. Refer to Section 22 07 19 for related piping insulation requirements, including materials, thicknesses, and acceptable manufacturers.

B. Provide insulation of PEX pipe and fittings as indicated below:

1. Insulate all domestic hot water and hot water return piping.
2. Insulate all domestic cold water piping:
   a. Subject to freezing conditions, specifically including (but not necessarily limited to) all piping located within exterior walls and to a point no less than 8'-0" inside the building envelope.
   b. Installed in an unconditioned space or poorly ventilated area with excessive moisture content.
   c. In no less than 1/2" rated insulation as required per manufacturer's requirements to ensure ASTM E84 installation compliance for return air plenums.

3.5 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Provide disinfection of the domestic water piping system in accordance with local code requirements and the manufacturer’s recommendations, as described below.

B. Prior to starting work, piping system shall be complete and initially flushed clean with potable water.

C. For hybrid systems, PEX piping shall be disinfected in accordance with AWWA C651. Use a chlorine solution of 50 parts per million (ppm) for 24 hours or 200 ppm for three hours. In no case should disinfection solution stand in the system for longer than 24 hours. Flush the system with potable water after disinfection.

3.6 TESTING OF PLUMBING PIPING SYSTEMS

A. During the progress of the work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B. Tests shall be conducted as part of this work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C. Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems testing shall be accomplished prior to the application of insulation.

D. All piping systems shall be leak tested and proved absolutely tight for a period of not less than 24 hours. Tests shall be witnessed by the Architect or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E. Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

F. Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

3.7 COMPLETE FUNCTIONING OF WORK

A. All work fairly implied as essential to the complete functioning of the systems shown on the Drawings and Specification shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specification to establish the type and function of systems but not to set forth each item essential to the functioning of any system. In case of doubt as to the work intended or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for Supplementary Instructions and Drawings, etc.

END OF SECTION

SECTION 22 11 19

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the specialties covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Hose Bibbs and Hydrants
2. Backflow Preventers
3. Water Hammer Arresters
4. Strainers and Filters
5. Thermostatic Mixing Valves
6. Digital Mixing Valves
7. Floor Drains and Floor Sinks
8. Cleanouts
9. Trap Primers
10. Interceptors and Separators
11. Roof Drains and Overflow Nozzles

1.3 RELATED WORK

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 10 00 - Plumbing Piping

C. Section 22 30 00 - Plumbing Equipment

D. Section 22 40 00 - Plumbing Fixtures

1.4 REFERENCES

A. ASME A112.6.3 - Floor and Trench Drains.

B. ASME A112.6.4 - Roof, Deck, and Balcony Drains.

C. ASME A112.14.1 - Backwater Valves.

D. ASME A112.1070 - Performance requirements for water temperature limiting devices.

E. ASSE 1010 - Performance Requirements for Water Hammer Arresters.

F. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.

G. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.

H. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies.

I. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies.

J. ASSE 1017 - Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems.

K. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance.

L. ASSE 1052 - Performance Requirements for Hose Connection Backflow Preventers.

M. ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves.

N. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices.

O. ASSE 1071 - Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment.

P. IAPMO (UPC) - Uniform Plumbing Code.

Q. ICC (IPC) - International Plumbing Code.

R. NSF 372 - Drinking Water System Components - Lead Content.

S. PDI-WH 201 - Water Hammer Arresters.

T. ASME A112.6.7 - Sanitary Floor Sinks

U. ASSE 1057 - Performance Requirements for Freeze Resistant Sanitary Yard Hydrants with Backflow Protection

V. ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves

W. AWWA C510 - Standard for Double Check Valve Backflow Prevention Assembly

X. NSF 61 - Drinking Water System Components - Health Effects

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit shop drawings and product data under provisions of Division One.

C. Include component sizes, rough-in requirements, service sizes, and finishes.

D. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of equipment and backflow preventers.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Operation Data: Indicate frequency of treatment required for interceptors and separators.

C. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled specialties to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept specialties on site in original factory packaging. Inspect for damage. Damaged specialties shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two loose keys for hose bibbs and hydrants and spare hose end vacuum breakers.

1.11 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes, and corrections.
6. On site demonstration.

1.12 REGULATORY REQUIREMENTS

A. Conform to applicable codes for the provision and installation of all required backflow prevention devices.

B. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

C. Provide backflow prevention assembly test and maintenance report for all devices. A printed and signed form by the licensed tester that performed the work shall be provided both to the Owner and to the Public Water System in accordance with TCEQ (Texas Commission on Environmental Quality) requirements.

PART 2 - PRODUCTS

2.1 HOSE BIBBS/HYDRANTS

A. General: Provide an operating handle for each loose keyed device on the project.

B. Hose Bibb: Bronze or brass construction, replaceable stem assembly, hose thread spout, complete with vandal resistant lockshield and ASSE 1011 integral vacuum breaker. Provide chrome plated and with removable key where exposed in public areas.

C. Wall Hydrant: Bronze or brass construction, replaceable stem assembly, hose thread spout, non-freeze, self-draining type with integral vacuum breaker. ASSE 1019. Unless specifically noted otherwise, provide recessed complete with heavy cast aluminum or nickel plated brass lockable box and loose key operator.

D. Floor Hydrant: Bronze or brass construction, replaceable stem assembly, hose thread spout, non-freeze, self-draining type with ASSE 1052 approved backflow preventer and vacuum breaker. All brass pipe and stem of suitable bury depth. Provide recessed in flush-mounted nickel plated brass lockable box with loose key operator. Ensure to located out of heavy traffic area unless box is appropriately rated.

E. Roof/Post Hydrant: Free-standing, low-lead, self-draining, non-freeze hydrant with cast iron handle and hose thread brass spout atop galvanized pipe riser. Complete with ASSE 1052 anti-siphon vacuum breaker. For rooftop applications provide complete with manufacturer's recommended mounting hardware for a secure installation and coordinate with roofing contractor to ensure a watertight seal is provided per the roofing system and any local code requirements.

F. ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam
7. Chicago (interior use hose bibbs only)
8. Woodford
9. Prier

2.2 RECESSED VALVE BOX

A. Washing Machine: Pre-formed galvanized or stainless steel rough-in box with brass long shank valves with wheel handles, threaded drain fitting for waste, and matching secured faceplate. PVC constructed box, faceplate, and bracket will be acceptable within dwelling units only, in residential occupancies only.

B. Refrigerator: Pre-formed galvanized or stainless steel rough-in box with brass long shank valve with wheel or quarter-turn handle and matching secured faceplate. PVC constructed box, faceplate, and bracket will be acceptable within dwelling units only, in residential occupancies only.

C. ACCEPTABLE MANUFACTURERS:

1. Guy Gray
2. Mifab
3. Sioux Chief
4. Oatey

2.3 BACKFLOW PREVENTERS

A. General Requirements: All assemblies shall be suited for the system anticipated working pressure and temperature as well as the intended orientation (vertical or horizontal) of the installation. All assemblies shall be lead-free per NSF 372, unless specifically noted otherwise on the Drawings.

B. Strainer Requirements: Lead-free compliant strainers shall be provided at all backflow preventers on the upstream side of each assembly. Strainer bodies shall be either bronze/cast copper alloy or of cast iron/ductile iron construction with an FDA approved epoxy coating. Screens and internal components shall be stainless steel.

C. Reduced Pressure Backflow Preventers: ASSE 1013; Bronze or FDA approved epoxy coated cast iron body with corrosion resistant internal parts and stainless steel springs; two independently operating, spring loaded check valves; intermediate internal pressure intermediate relief valve with water outlet; test cocks and isolation valves.

D. Double Check Valve Assemblies: ASSE 1015; Cast copper alloy or FDA approved epoxy coated cast iron body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves, test cocks and isolation valves.

E. Dual Check Valve with Intermediate Atmospheric Vent: ASSE 1012; Brass body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

F. ACCEPTABLE MANUFACTURERS:

1. Watts
2. Wilkins
3. Ames
4. Febco
5. Conbraco

2.4 WATER HAMMER ARRESTERS

A. Engineered water hammer arresters: ASSE 1010 listed, lead-free, pre-charged, permanently sealed, maintenance- free, suited for concealed installation, with a working temperature range of 33 to no less than 212 degrees F and a maximum working pressure of no less than 250 psi during pressure surges. Stainless steel or copper body construction. Shall be sized and located in accordance with Plumbing Drainage Institute standard PDI-WH 201.

B. ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Wade
5. Josam
6. P.P.P.
7. Sioux Chief

2.5 THERMOSTATIC MIXING VALVES

A. Provide thermostatic mixing valves in accordance with manufacturer’s recommendations and as indicated and scheduled on Drawings.

1. Unless scheduled otherwise, all units other than under-counter point of use units shall be provided complete in lockable cabinet of 16 gage (1.5 mm) prime coated steel when located in finished areas.
2. All under-counter point of use units shall be provided complete with integral checks and dual stainless steel strainers on inlets for protection against fouling.

B. Types and Requirements:

1. Where hot and cold water is supplied to emergency safety fixtures, the temperature shall be controlled by a temperature actuated mixing valve complying with ASSE 1071.
2. Valves for individual showers are addressed in Section 22 40 00 - Plumbing Fixtures
3. (Master) mixing valves serving multiple showers, each with a single tempered water supply pipe, shall conform to ASSE 1069 or CSA B125.3. Such valves shall be provided complete with unions, checks, and ball valves at all connections as well as a temperature gauge on the outgoing water line.
4. Mixing valves serving (athletic area) whirlpool applications shall comform to ASSE 1070 / ASME A112.1070 / CSA B125.70 or CSA B125.3. Such valves shall also be configured with appurtenances as described above.
5. Mixing valves supplying tempered water to lavatories and sinks shall conform to ASSE 1070 / ASME A112.1070 / CSA B125.70 or CSA B125.3.

C. ACCEPTABLE MANUFACTURERS:

1. Bradley
2. Powers
3. Symmons
4. Acorn

2.6 DIGITAL MIXING VALVES

A. Provide digital mixing valves in accordance with manufacturer's recommendations and as indicated and scheduled on Drawings

B. Valve assembly shall include, but not necessarily be limited to, the following features:

1. Pre-piped, wired, and tested complete from the manufacturer, on a rack suited for wall-mounted installation.
2. Electronic based temperature and pressure sensor elements continuously monitoring hot and cold water inlet supplies, mixed water outlet, and tempered water return.
3. Continuously modulating high-speed actuator located external to the associated three-way mixing valve where it is not subject to potential water leakage from the valve.
4. Certified to ASSE 1017 and capable of ± 2 degrees F temperature regulation.
5. Type L copper and lead-free valves, both full port stainless steel ball quarter turn and check type.
6. UL listed and lead-free listed to NSF 372.
7. Bronze-fitted, integrated hot water return circulating pump operated by the control module based on pre-set return temperature offset.
8. Smart controller interface with full-color, user selectable touch screen display complete with NEMA 3 enclosure and user programmable high temperature alarm and security pass code.
9. Built-in BAS compatibility.
10. Five (5) year manufacturer warranty.

C. ACCEPTABLE MANUFACTURERS:

1. Powers
2. Armstrong

2.7 FLOOR DRAINS AND FLOOR SINKS

A. Provide floor drains and floor sinks in accordance with manufacturer's recommendations, as appropriate for floor construction per ASME A112.6.3, and as indicated and scheduled on Drawings.

B. Provide clamping devices for all drains in membrane floor areas.

C. ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam

D. Provide drains of suitable and compatible material for specialized piping systems conveying acid waste.

2.8 CLEANOUTS

A. General: Provide cleanouts as indicated and scheduled on Drawings and also as required by the prevailing code, whether shown on the Drawings or not.

B. Construction: All cleanouts shall have tapered PVC, ABS, or polypropylene plugs.

C. Provide clamping devices for all cleanouts in membrane floor areas.

D. Provide cleanouts of suitable and compatible material for specialized piping systems conveying acid waste.

E. Types:

1. Finished floor cleanouts: Provide cast iron body, with adjustable floor level assembly, and round nickel bronze scoriated top.
2. Resilient or tile finished floor cleanouts: Provide cast iron body, with adjustable floor level assembly, and round nickel-bronze top with gasketed water tight cover and depressed top to receive flooring finish material.
3. Interior finished wall cleanouts: Provide cast iron tee body or cleanout ferrule as required for wall construction and provide counter-sunk plug with stainless steel access cover and securing screw(s).
4. Interior unfinished accessible cleanouts: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

F. ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam

2.9 TRAP PRIMERS

A. General: Provide trap primers as indicated and scheduled on Drawings and in accordance with manufacturer's recommendations.

B. ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam
7. P.P.P.
8. Sioux Chief

2.10 INTERCEPTORS

A. General requirements:

1. Provide in type, materials of construction, and with appurtenances as indicated on the Drawings and as required for a complete, functioning, and compliant installation. This shall include, but not necessarily be limited to, the following: venting, flow control, inlet and outlet piping adapters/transitions, and cleanouts.
2. Unless specifically noted otherwise, each interceptor shall be provided with an approved sampling well/sampling port in accordance with local AHJ requirements.
3. All interceptors shall be a of flow rate/capacity, size, and design as suited to the waste stream being served and in accordance with local AHJ requirements.
4. Buried interceptors shall be provided with suitable extensions up to finished grade/paving.
5. Buried interceptors shall be provided with approved and suitable access lids/manhole covers.
   a. In vehicular traffic areas these shall be provided in material and load rating accordingly, suited for the weight of the traffic to be encountered.
   b. In no case shall lids be rated for anything less than pedestrian traffic.
   c. All lids shall be lined/gasketed for odor control.
6. Where steel constructed interceptors are provided buried, vaulted, or in-floor they shall be fully enamel coated on the exterior with bituminous coating outside as well for corrosion resistance.
7. Interceptors shall not be provided of a material or at an installed depth they are not suited for. Maximum installation depths and bedding-backfill-bury requirements shall be adhered to in strict accordance with the manufacturer's recommendations.

8. Buried interceptors in high water table locations shall be provided complete with the manufacturer's approved anchoring kit.
9. Interceptor placement and installation shall be coordinated accordingly with adjacent items and equipment, floor/slab construction, site paving/grading, etc. to ensure a compliant installation and all required service and maintenance access.
10. IAPMO (UPC), ICC (IPC), and local AHJ approval.
11. Polyethylene constructed interceptors shall be lifetime guaranteed.

B. Grease Interceptors:

1. Hydromechanical grease interceptors shall be ASME A112.14.3 / PDI-G 101 compliant.
2. Gravity grease interceptors shall be IAPMO / ANSI Z1001 compliant.
3. Concrete constructed grease interceptors shall be provided complete with interior PVC liner from the manufacturer.
4. Grease interceptors shall have a maximum operating temperature of no less than 150 degrees F continuous.
5. Polyethylene constructed grease interceptors shall be third party performance tested. For hydromechanical units, this documentation shall include actual grease retention capacity in pounds.
6. Acceptable manufacturers (where such units are detailed/specified on the Drawings):
   a. Steel constructed: J.R. Smith, Zurn, Wade, Josam, Park-USA
   b. Precast concrete constructed: Park-USA, Old Castle Precast
   c. Fiberglass reinforced plastic (FRP) constructed: Zurn Proceptor, Green Turtle Technologies

2.11 BACKWATER VALVES

A. ASME A112.14.1; Lacquered cast iron body and cover, brass valve, access cover, extension sleeve as required and cover at finished elevation

B. ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam

2.12 ROOF DRAINS, PLANTER DRAINS, AND OVERFLOW NOZZLES

A. Roof drains (RD): ASME A112.6.4; Lacquered cast iron body with sump, removable aluminum dome strainer, membrane flange and clamp with integral gravel stop, adjustable underdeck clamp, roof sump receiver, waterproofing anchor flange, adjustable extension as required for insulation, perforated or slotted ballast guard extension for inverted roof.

B. Roof overflow drains (OD): Lacquered cast iron body and features similar to roof drain, with 2 inch external water dam or pipe extended to 2 inches above flood elevation.

C. Planter drains: Lacquered cast iron body with flange, integral clamping collar, seepage openings and either adjustable perforated standpipe (length as necessary) with secured dome or dome with secured stainless steel screen.

D. ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to provide intended performance.

B. Water hammer arresters:

1. The contractor shall provide water hammer arresters as shown on Drawings and also in accordance with PDI-WH 201, whether shown on Drawings or not.
2. Water hammer arresters shall be PDI certified and sized and placed as recommended by manufacturer.
3. Provide above lay-in ceiling, within chase or wall or above solid ceiling complete with access panel, or otherwise accessible location complete with isolation valve to facilitate replacement.
4. Provide for both domestic hot and cold water services.
5. The provision of air chambers for the control of water hammer shall not be acceptable, but for within dwelling units only, in residential occupancies only.

C. Backflow preventers:

1. Provide strainers at all backflow preventers.
2. Contractor shall certify all newly installed backflow preventers and provide proof of certification to the Owner.
3. Pipe relief line from backflow preventer via manufacturer’s air gap assembly, full size to nearest suitable drain. Such routing shall not pose a trip hazard. Where a suitable drain of appropriate size is not provided, route line to the outdoors.
4. All backflow preventers shall be securely supported with wall supports and/or pipe stands as appropriate for the size and weight of the unit and shall be installed with sufficient access and clearance for testing and maintenance. Unless specifically noted otherwise on Drawings, all backflow preventers shall be installed at 48”-60” above finished floor.

D. Cleanouts:

1. Provide two-way cleanouts at all waste outfalls from the building.

2. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at all cleanouts for access and for rodding of drainage system.
3. Wall cleanouts provided at the end of horizontal piping runs shall be installed vertically above the flow line of the pipe served.
4. All cleanouts outside of building on grade shall be set in an 18" x 18" x 4" thick concrete pad, flush with final grade/paving.
5. All cleanouts shall be the same nominal size as the pipe they serve, up to 4 inches. For pipes larger than 4 inches, provide a 4 inch cleanout.

E. Interceptors:

1. Coordinate with casework to ensure that all interceptors are readily accessible and removable for servicing and cleaning.
2. Coordinate with casework to ensure that all point of use interceptors do not interfere with required accessibility requirements. Provide offset(s) as required and in accordance with code.
3. Provide approved sampling well downstream of centralized interceptors and separators and in all such locations where required by the local Authority Having Jurisdiction.

F. Trap primers:

1. In unfinished areas such as mechanical rooms, such devices may be installed exposed.
2. In finished areas, all devices must be installed concealed from public view. If not readily accessible (such as above a lay-in ceiling) ensure to provide an access door.

END OF SECTION

SECTION 22 11 26

PROPANE GAS PIPING SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the piping system covered by this section, with all appurtenances, ready for the Owner's use. This shall include, but not necessarily be limited to, the following:

1. Pipe and pipe fittings.
2. Adapters, transitions, final flexible connectors.
3. Valves, regulators, and regulator vents.
4. Metering, if and as indicated.
5. Testing.

B. Coordinate the following with a licensed local propane company:

1. Propane storage tank size. Whether or not tank size(s) is/are indicated on the Drawings, confirm tank sizing to ensure:
   a. Capacity is suited to the fuel gas needs of the project.
   b. Capacity is consistent with the refill frequency expectations of the Owner or end-user.
   c. Size is compliant with local AHJ requirements.
   d. Tank(s) can be located on the site and installed in a compliant fashion in accordance with the requirements of NFPA 58 and all other applicable state and local codes and ordinances.
2. Propane storage tank provision. Unless specifically noted otherwise on the Drawings, a licensed local propane company shall provide a stationary propane storage tank (or tanks) complete with all required valves-fittings-gauges and safety devices for a complete, compliant, and functional installation. The tank shall be specifically designed for and designated by the manufacturer for either above ground or below ground installation, as suited to the needs of the project.
3. The contractor shall ensure that a suitable concrete pad is provided for each outdoor tank, a suitable excavation, anchoring and burial is provided for each underground tank, and that all required site protective measures for the tank(s) and system (depth of burial and cover, cathodic protection, bollards, etc.) are provided accordingly.
4. Propane tank(s) shall be filled prior to project turnover to the Owner.

C. Pay for all fees, testing, inspections, and secure all necessary permits required for the system.

1.3 RELATED WORK

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 05 53 - Identification for Plumbing Piping and Equipment

C. Section 22 30 00 - Plumbing Equipment

1.4 REFERENCES

A. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators.

B. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

D. ASME B16.11 - Forged Fittings, Socket-welding and Threaded.

E. ASME B31.1 - Power Piping.

F. ASME BPVC - Boiler and Pressure Vessel Code.

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.

H. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels.

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

J. ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications.

K. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

L. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings.

M. NFPA 54 - National Fuel Gas Code.

N. NFPA 58 - Liquefied Petroleum Gas Code.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

D. Foreign pipe, fittings or valves are unacceptable.

E. Welding Materials and Procedures: Conform to ASME BPVC and applicable state labor regulations.

F. Welders Certification: In accordance with ASME BPVC-IX.

G. Materials, design, fabrication, and testing-inspection shall conform to the requirements of ASME B31.1.

1.6 SUBMITTALS

A. Submit product data under provisions of Division One.

B. Include pipe materials, pipe fittings, valves, regulators, and accessories. Provide manufacturer’s catalog information, product certifications, and country of origin. Indicate valve data and ratings.

C. Submit complete dimensional and technical product data for an ASME BPVC-VIII-1 compliant liquid propane storage tank with all required appurtenances.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of valves, regulators, tanks, and any meters.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.

B. Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E. Provide temporary protective coating on steel valves.

F. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

G. Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A. Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

A. Perform and provide all work in accordance with plumbing and building codes having jurisdiction.

B. Ensure compliance with fire marshal, state and local codes, and Texas Railroad Commission requirements.

C. All sleeves passing through return air plenum space shall be of compliant material.

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. All gas piping above ground shall be ASTM A53/A53M schedule 40 black steel pipe as manufactured by U.S. Steel Tubular Products, Republic Steel, Youngstown Pipe & Steel, or approved equal domestic manufacturer.

B. All gas piping larger than 2” shall have welded fittings. Threaded fittings and joints will only be permitted for sizes 2" and smaller. Unions and valves will not be permitted above ceilings or in walls or chases.

C. All steel pipe fittings shall be as follows:

1. All dimensions and design for forged steel fittings shall conform to ASME B16.11.
2. The material for all forged carbon steel fittings shall conform to ASTM A105/A105M.
3. All welding fittings shall be factory-made and shall be full line size, for each tee, branch, elbow, etc., with reducers after fittings, if required.
4. All threads shall be taper pipe threads and conform to ASME B1.20.1.
5. All threaded fittings shall be ASME B16.3 Class 150 malleable iron by Ward Manufacturing or approved equal. Threaded joints shall be made up with graphite and oil or Teflon tape.
6. All pipe fittings shall be from a domestic manufacturer.

D. All underground gas piping with 5 pound working pressure or less shall be as follows:

1. The pipe shall be yellow polyethylene with socket heat fusion joints and fittings per ASTM D2513. Pipe sizes 1-1/2" and 2" shall be SDR 11, (PE 2708) and pipe sizes 3" and 4" shall be SDR 11.5 (PE 2708).
2. All socket heat fusion fittings shall be D.O.T. approved and meet ASTM D2513, ASTM D2683 and ASME B31.8 codes.
3. All gas valves below grade shall be ASTM D2513 polyethylene constructed ball type with NBR seat and seals, rated for natural gas use. Hubbell/Lyall or approved equivalent. All such valves shall be placed in a cast-iron valve box of an adequate size for accessibility and maintenance.
4. All transition meter risers shall be D.O.T. approved anode-less service type, fusion coupled and PE 2708 rated.
5. The contractor shall take thermal expansion under consideration during installation. The contractor shall follow all requirements set by the manufacturer to protect the system from damage due to thermal expansion.
6. The contractor shall provide detector tape approximately 12" above all gas piping.
7. Wrap pipe with 18 gauge minimum copper tracer wire.

E. Gas piping installed in unventilated spaces shall be routed in properly vented continuous sleeve where required by the building code.

F. Gas valves shall be UL listed as follows:

1. Ball Valves: Nibco T585-70-UL for 1/4” to 1” and T580-70-UL for 1-1/4” to 3”.
2. Plug Valves: ASTM A126 cast iron quarter turn plug valve with no less than 175 psi maximum cold working pressure (CWP).
   a. DeZurik Eccentric plug valve
   b. Flowserve/Nordstrom short pattern all-iron lubricated plug valve, Super Nordstrom or Nordstrom Bolted Gland type.

G. Gas pressure regulators:

1. Shall be capable of reducing the incoming gas pressure to the intended outgoing gas pressure at the capacities required by the system gas demand.
2. Shall be installed in accordance with manufacturer's recommendations, accessible for servicing, and protected against physical damage accordingly.
3. Shall not be located above ceilings or in similar installations.

4. Shall be provided with overpressure protection devices (OPD's) where required. Reference NFPA 54, Section 5.8 in particular.
5. Line pressure regulators shall be listed in accordance with ANSI Z21.80/CSA 6.22.
6. Shall be as manufactured by Sensus/Rockwell, Emerson/Fisher, Maxitrol, or approved equal.

H. All gas regulators located inside the building shall be vented to the outdoors with schedule 40 black steel pipe. This includes all regulators provided with mechanical and plumbing equipment and all other regulators provided under this contract.

1. Vent piping shall be the full size of regulatory port opening, or as recommended by regulator manufacturer.
2. Each vent shall run independently of any other regulator vents.
3. Each vent shall terminate at a height and in a location no less than 10'-0" from any door/window/outside air intake and no less than 3'-0" from a possible source of ignition.
4. Each vent shall be located and designed to prevent the entry of water, insects, or other foreign materials that could cause blockage. Each vent shall terminate with an elbow oriented downward, fitted with 12x12 mesh stainless steel screen in the outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All piping, valves, and appurtenances shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

C. All underground gas piping shall be laid on 6" of wet compact bank sand approximately 24" below grade and buried in a manner to protect it from damage. Backfill trench with wet compacted bank sand to 6" above pipe. The remainder of backfill shall be selected backfill and shall meet all compaction requirements set forth by the general trenching and backfill requirements.

D. Provide lever handle gas valve, drip leg and union at each piece of equipment and where indicated.

E. At kitchen appliances provide commercial grade, ANSI Z21.69/ANSI Z21.24 compliant flexible connections, stationary or moveable (as necessary for the equipment served) of suitable lengths.

F. All gas lines entering building shall be valved on the exterior of the building above grade. All gas lines entering (or leaving) buildings shall be sleeved through the exterior wall above grade and sealed watertight.

G. Refer to Section 22 05 53 for valve and piping identification requirements, including painting and labeling (pipe markers). Provide as specified.

H. Refer to Section 22 05 29 for pipe hanger and support requirements. Provide as specified.

I. Gas piping shall not be routed through or beneath a building slab unless specifically indicated as such on the Drawings. For such installations:

1. The gas piping shall be sleeved, sealed, and vented to the outdoors in accordance with the requirements of NFPA 54 or the prevailing gas code, or whichever is the more stringent requirement.
2. All sleeves must be of suitable material for the installed location. This shall include, but is not necessarily limited to, providing sleeves of compliant material and construction where passing through return air plenum spaces.

J. Provide an accessibly located valved and capped test tee for each distinct system to facilitate regular pressure testing of all gas piping from the outlet of the shutoff valve at each LP gas storage container (or upstream of each meter) to each inlet valve of each appliance. Reference Texas Administrative Code Title 16, Part 1, Chapter 9, Subchapter A, Rule 9.41 for additional information as necessary.

3.2 TESTING OF GAS PIPING SYSTEMS

A. All gas system testing shall be in compliance with local codes or as required in NFPA 54 National Fuel Gas Code, whichever is the more stringent requirement.

B. All work shall be performed by a Journeyman Plumber holding current State and local licenses.

C. All tests shall be accomplished during normal working hours and after having given due notification to building owner, construction manager or designee, of tests to be performed. All tests shall be performed in the presence of and witnessed by the building owners representative or designee.

D. All gas system piping shall be subjected to a pneumatic test pressure of 60 psig for not less than 2 hours upon completion of all rough-in work and prior to covering. While the systems are subjected to this air pressure test, all joints shall have a soapy water solution applied and shall be observed for leaks. During test period there shall be no perceptible drop in test gage pressure

E. A final test shall be performed after all portions of the piping system are completely installed and covered. The entire system shall be tested, with all system outlets plugged or capped, before any equipment or appliances are connected to the piping.

1. Final test shall be with mercury, measured with a manometer or slope gage. Test pressures shall in no case be less than one and one half times the normal operating pressure or as listed below; which ever is the greater:
   a. 10.5 inches mercury (5 psig) for 4 ounce system
   b. 21.0 inches mercury (1 psig) for 8 ounce system
2. Tests shall be for a period of not less than 30 minutes and shall prove absolutely tight, showing no perceptible drop, for the entire test period.

F. Purge air from test piping before connecting equipment or appliances. Purge air to outdoors or to ventilated space of sufficient volume to prevent accumulation of flammable mixtures.

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the equipment covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Domestic Water Heaters
2. Water Softeners
3. In-line Circulator Pumps
4. Domestic Pressure Booster Systems
5. Sump Pumps and Sewage Ejectors

1.3 RELATED SECTIONS

A. Section 11 40 00 - Foodservice Equipment

B. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

C. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

D. Section 22 10 00 - Plumbing Piping

E. Section 22 11 19 - Plumbing Specialties

F. Section 26 05 19 - Wire, Cable and Related Materials

1.4 REFERENCES

A. 10 CFR 430, Appendix E to Subpart B - Uniform Test Method for Measuring the Energy Consumption of Water Heaters.

B. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.

C. ANSI Z21.10.3 - Gas-Fired Water Heaters - Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices.

F. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels.

G. ICC (IECC) - International Energy Conservation Code.

H. NFPA 54 - National Fuel Gas Code.

I. NFPA 70 - National Electrical Code.

J. NSF 61 - Drinking Water System Components - Health Effects.

K. SCAQMD 1146.2 - Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters.

L. UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters.

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Perform Work in accordance with Authorities Having Jurisdiction.

C. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

D. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. American Gas Association (AGA).
2. National Sanitation Foundation (NSF).
3. American Society of Mechanical Engineers (ASME).
4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
5. National Electrical Manufacturers' Association (NEMA).
6. Underwriters Laboratories (UL).
7. American Society of Plumbing Engineers (ASPE)

E. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Shop Drawings:

1. Include water heater and packaged heating system dimensions, sizes and locations of all connections, and performance data.
2. Include dimensions of tanks, tank lining and insulation methods, anchors, attachments, lifting points, sizes and locations of all connections and drains.
3. Include water softening equipment dimensions, sizes and locations of all connections, performance data and capacities, backwash requirements.
4. Include booster system skid dimensions, sizes and locations of all connections, and performance data. Include such information for any field connected items, including, but not necessarily limited to, hydro-pneumatic tanks.
5. Include manufacturer's recommended space requirements, clearances, and maintenance access.

C. Product Data:

1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
2. Indicate pump type, materials of construction, capacity, power requirements, and any affected adjacent construction.
3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
4. Provide electrical characteristics and power and controls connection requirements/capabilities.

D. Manufacturer's Installation Instructions.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of equipment.

C. Provide written start-up reports.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 22.

B. Operation Data: Include manufacturer's operating instructions, common trouble conditions and remedies, and trouble-shooting protocols.

C. Maintenance Data: Include routine maintenance items and corresponding intervals, identify typical replacement parts including part numbers and availability. Provide location and full contact information including after-hours maintenance/support telephone numbers for manufacturer authorized maintenance and repair companies.

1.9 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled equipment to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of equipment to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept equipment on site in original factory packaging. Inspect for damage. Damaged equipment shall not be acceptable.

D. STORAGE: Store equipment in a clean, dry location, protected from weather and damage.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Division One.

B. Provide two sets of electric water heater elements.

1.11 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two weeks prior to the proposed training session for review and approval.

B. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes, and corrections.
6. On site demonstration.

1.12 REGULATORY REQUIREMENTS

A. Conform to AGA, NSF, NFPA 54, NFPA 70 and UL 1453 requirements for water heaters.

B. Conform to ASME BPVC-VIII-1 for manufacture of pressure vessels for heat exchangers.

C. Conform to water heater minimum efficiency requirements prescribed by ICC (IECC) and ASHRAE Std 90.1 I-P

D. Water heaters shall be tested and rated in compliance with 10 CFR 430, Appendix E to Subpart B or ANSI Z21.10.3 as applicable.

1.13 WARRANTY

A. Provide one year warranty under provisions of Division One, unless specifically noted otherwise.

B. Warranty: Include coverage of domestic water heaters and packaged systems, water storage tanks, water softeners, and domestic pressure booster systems.

PART 2 - PRODUCTS

2.1 RESIDENTIAL GAS FIRED WATER HEATER (STORAGE TYPE)

A. Acceptable Manufacturers:

1. A.O. Smith
2. State
3. Rheem
4. Lochinvar
5. Bradford White

B. Type: Automatic, propane gas-fired, vertical storage, atmospheric vent.

C. Tank: Glass lined welded steel with single flue passage, flue baffle and draft hood; thermally insulated with non-CFC foam insulation and encased in corrosion-resistant steel jacket with baked-on enamel finish and with slightly elevated base.

D. Controls: Electronic gas control without external power source, low-NOx burner; spark ignition and pilot, adjustable temperature range. Thermal cutoff (TCO) device.

E. Accessories: Factory installed heat trap nipples, brass drain valve and dip tube, long life anode, and ASME temperature and pressure relief valve.

F. Approvals:

1. Listed according to ANSI Z21.10.1 - CSA 4.1 standards governing storage tank type gas water heaters.
2. Thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE Std 90.1 I-P
3. Certified at maximum 150 psi hydrostatic working pressure.

2.2 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Acceptable Manufacturers:

1. Watts
2. Amtrol
3. Elbi
4. Bell and Gossett

B. Rating: Ensure suitable pressure rating of tank for expected system pressure.

C. Construction: Welded steel construction, corrosion-proof anti-microbial polypropylene liner, long-life butyl diaphragm, stainless steel system connection, factory pre-charged, complete with welded air charge fitting with protective cap. Suitable for in-line installation or factory provided with stand/legs for floor-mounted installation.

2.3 WATER SOFTENER

A. Acceptable Manufacturers/Equipment Providers:

1. Watertech Services
2. Unity
3. Marlo, Inc.
4. Mueller Water Conditioning, Inc.

B. Performance:

1. The water softening equipment shall have the minimum capacity and performance as scheduled on the Drawings.

C. Tanks:

1. Design tanks for a minimum working pressure of 100 psi.
2. Design the side shell height to allow a minimum free-board space of 50% of the mineral bed depth for adequate expansion during backwashing.
3. Fiberglass tanks shall be constructed of non-corroding fiberglass reinforced plastic construction, complete with NSF and UL listed liner.

D. Collector:

1. Provide the softener with an approved lower distribution system.
   a. Non-clogging strainers to collect soft water and distribute the backwash water.
   b. Covered with a minimum of 3" of 1/8" x 1/16" gravel to ensure even distribution of water.

E. Brine System:

1. Provide a combination salt storage and brine measuring tank with cover.
   a. Large enough to hold salt for at least 10 regenerations of full salting between refills.
   b. Molded of corrosion free, rigid polyethylene.
2. Equip the brine tank with:
   a. An elevated salt plate for the collection of concentrated brine.
   b. A suitable chamber for housing an automatic air eliminator safety valve.

F. Automatic Controls:

1. Provide a multi-port main control valve or nest of diaphragm valves.
   a. Hydraulically actuated.
   b. Four position type.
   c. Accomplish the regeneration steps of backwash, brine-slow rinse, rapid rinse and service.
   d. Include fixed and self-adjusting flow regulators necessary to properly control the rate of flow during the backwash and brine-rinse.
   e. Pressures between 30 and 120 psi.

f. Designed to prevent hard water bypass to service during the regeneration cycle.
g. Side mount control valves shall be connected with factory pre-piped galvanized piping with dielectric connectors.

2. Control regeneration by a flow sensor with push-button manual override.
   a. Permit regeneration at any time of day or night, any day or every day of the week.
   b. Make provision for individual adjustment of the backwash and brine-rinse cycles.
   c. Provide outputs to the BMS system from the electronic controller of general alarm conditions and flow sensor data.
3. Enclose control mechanisms in a gasketed moisture resistant case, rated as a NEMA III or NEMA 12 enclosure and conforming to UL specifications.

G. Automatic Brine System:

1. Provide a control system to:
   a. Open to admit brine.
   b. Close to prevent the entrance of air.
   c. Refill the brine tank with the proper amount of water.
2. Accomplish regulation of the brine dosage by adjustment of a salt dosage dial in the time clock case.
3. Design the system to allow proper refilling regardless of the salt level in the brine tank.
4. Furnish a float-operated safety valve as standard equipment to safeguard against brine tank overflow.

H. Mineral:

1. Charge the system with a mineral of the type designed as NSF grade non-phenolic polystyrene chlorine resistant resin.
   a. Minimum exchange capacity of 30,000 grains per cubic foot when regenerated with 0.5 lbs. of salt per 1,000 grains of exchange capacity.
   b. A solid, of the proper particle size, (not more than 1.8% through 50 mesh U.S. standard screens, wet screening).
   c. Contain no agglomerates, shells, plates or other shapes which might interfere with the normal function of the water softener.

I. Water Testing Equipment:

1. Provide a sample cock installed for obtaining samples of the effluent water.
2. Provide a complete water testing kit for conducting a water hardness titration test.
3. Provide inlet and outlet pressure gauges.

J. Installation and Training:

1. Softener(s) and brine tanks shall be provided on concrete housekeeping pads.
2. Equipment shall be properly supported and anchored per the manufacturer's recommendations or as needed for stability.
3. Provide training per 1.11.

2.4 IN-LINE CIRCULATOR PUMPS

A. Acceptable Manufacturers:

1. Grundfos
2. Bell & Gossett
3. Armstrong

B. Type: Canned motor type.

C. Housing: Bronze or stainless steel, rated for 125 psig working pressure.

D. Impeller: 304 stainless steel.

E. Shaft: Stainless steel or aluminum oxide ceramic.

F. Thermal Protection: Internal.

2.5 SUMP PUMPS AND SEWAGE EJECTORS

A. Acceptable Manufacturers:

1. Grundfos
2. Weil
3. Hydromatic
4. Liberty
5. Zoeller

B. Type and Arrangement:

1. Refer to Drawings for pump types, performance requirements, and power requirements.
2. Refer to Drawings for basin ("station") sizes, depths, inlets, outlets, and construction. All sealed basins shall be properly vented.
3. **With the exception of elevator sump pump applications**, at a minimum each pump installation shall be duplexed (with equally performing pumps, each sized for the operational condition) unless specifically identified otherwise on the Drawings.

C. Electrical: Motor thermal overload protection. Voltage, phase, and horsepower as indicated on Drawings.

D. Construction: Cast iron pump body with carbon and ceramic mechanical seals. 100% baked on powder coated epoxy finish. Stainless steel external hardware.

E. Impeller: Bronze or stainless steel non-clogging vortex type with stainless steel shaft.

F. Controls/Alarm General Requirements:

1. Provide indoor/outdoor alarm system and pump control complete with NEMA 4X waterproof enclosure, automatic alternation of pumps, audible alarm, silence switch, red alarm beacon, and HOA switch.

2. Provide corrosion resistant floats with power cords and configuration for pumps on/off and high water alarm.
3. Capable of single point power connection.
4. Provide an auxiliary set of contacts for connection or remote alarm circuit to BAS.
5. At elevator sumps, in lieu of float control, provide an approved oil sensing and alarm system complete with control & alarm panel to govern pump operation. See-Water, Inc. or pre-approved equivalent.

G. General Requirements:

1. Each pump shall be arranged to function independently in case of overload or mechanical failure.
2. Each pump receiving the discharge of water closets or urinals must have a pumping capacity of 20 gpm minimum and must also have 2 inch diameter solids handling capacity (unless a grinder type pump is employed).
3. Each pump discharge line shall be 3 inch minimum. However, a 2 inch discharge shall be acceptable for elevator sump pump applications.
4. The discharge pipe from each pump shall be provided with an accessible line sized swing check valve and gate or ball valve. Valve shall be located in accordance with the prevailing code.
5. Basins shall be gas tight and of sufficient size and shape to physically accommodate pumps and appurtenances, inlet and outlet pipes, and to ensure acceptable run times per manufacturer's recommendations.
6. Pumps shall be provided with suitable provisions to ensure easy removal for inspection, maintenance and replacement. This may require appurtenances such as (but not necessarily limited to): guide rail systems with either stainless steel or galvanized pipe rails, quick disconnect sealing flanges at pumps, and corrosion resistant chains or cables attached to brackets atop the pump bodies.
7. Elevator sump pump applications shall comply with the requirements of the prevailing code and ASME A17.1

H. Provide training per 1.11.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Install water heaters in accordance with manufacturer's instructions and to AGA, NSF, NFPA 54 and UL requirements.

B. Coordinate with plumbing piping and related work to achieve operating system.

C. Provide venting and vent piping in accordance with both code requirements and manufacturer's recommendations. The material and installation provided must not only be compatible with the equipment served but must also be suited to and acceptable per project conditions. Any material to be provided in a return air plenum must be compliant for such use.

D. Provide a properly sized thermal expansion tank downstream of the associated check valve in the cold water supply to the heater.

E. Provide a thermometer at the hot water outlet piping from each water heater.

F. Provide a line sized shut-off valve in the cold water supply to and in the hot water outlet from each heater, close to each heater.

G. Provide approved heat traps at all storage type water heaters not furnished from the manufacturer with integral heat traps or heat trap nipples.

H. Provide a line size plug cock in the gas supply close to each gas-fired water heater.

I. Provide approved dielectric couplings at all hot and cold water connections to each heater/tank, and at the T&P relief valve connection.

J. All tank type water heaters with more than 20 gallons of storage capacity shall be floor mounted on a concrete housekeeping pad, unless specifically indicated otherwise on the Drawings.

K. Each tank type water heater shall be installed within a suitably sized galvanized drain pan. Securely elevate the base of each heater above the floor of the drain pan with structurally sound, non-ferrous, non-absorbent supports. Drain pan shall have no less than a 3/4" piped drain outlet.

L. All water heater drain lines shall be full size, copper, and routed to indirect waste receptors.

M. Startup:

1. Startup of all water heaters shall be in strict accordance with manufacturer's recommendations.
2. Ensure that storage type water heaters are full of water and downstream fixtures have been run for no less than 3 minutes in order to purge any trapped air from the water heater tank prior to heater startup.

3.2 CARBON MONOXIDE AND FUEL GAS DETECTION

A. In each boiler room, and in each water heater room with more than 200,000 BTUH total heating capacity or more than 120 gallons of total storage, provide detectors for carbon monoxide and natural gas (or propane, as appropriate), complete with manual reset.

B. Each detector shall be configured/interlocked to:

1. Disable the equipment burners upon loss of power to the detector.
2. Disable the equipment burners when the measured level of carbon monoxide rises above 50 ppm or 10% LEL (lower explosive limit) of the fuel gas.

3.3 PUMP INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide air cock and drain connection on horizontal pump casings.

C. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

D. Provide line sized isolating valve and line sized soft seated check valve on each submersible or sump pump discharge. Ensure to drill a 3/16" diameter horizontal weep hole near the base of the discharge piping to allow for venting and prevent air lock of the pump.

E. Provide line sized isolating valve and strainer at inlet and line sized soft seated check valve and line sized isolating valve at outlet of each in line circulator pump. Provide unions on both sides of pump.

F. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

G. 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.

H. Align and verify alignment of base mounted pumps prior to start-up. Provide alignment certificate to engineer prior to start-up.

3.4 WATER SOFTENER INSTALLATION

A. Arrange piping for easy dismantling to permit cleaning and service.

B. Install the system in accordance with the manufacturer's installation, start-up and service instructions.

C. Provide a complete set of instructions covering the installation, operation and servicing of the water softener.

D. Provide system manufacturer start-up service.

1. Provide the services of factory trained service technicians to start up the system. Technicians shall be trained and experienced on the work they conduct. Technician shall possess a current Class III WTS License from TCEQ.
2. Provide and fill the brine tank with enough food grade pellet salt for ten (10) regenerations at maximum brining.
3. Monitor the operation of the softener and set the time clock for an average period between cycles so that regeneration occurs in the early morning hours during a period of zero usage
4. Follow the manufacturer's start up procedures.
   a. Verify interlocks.
   b. Test and verify operation of controls.
   c. Calibrate controls.

3.5 DOMESTIC HOT WATER STORAGE TANK INSTALLATION

A. Install tanks in accordance with manufacturer's instructions.

B. Provide steel pipe support for tanks, independent of building structural framing members.

C. Clean and flush tank after installation. Seal until pipe connections are made.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 22 02 00 - Basic Materials and Methods for Plumbing shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the fixtures covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Plumbing Fixtures
2. Fixture Carriers
3. Faucets, Supplies, and Trim
4. Flushometers

1.3 RELATED WORK

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 10 00 - Plumbing Piping

C. Section 22 11 19 - Plumbing Specialties

D. Section 22 30 00 - Plumbing Equipment

1.4 REFERENCES

A. ASME A112.4.3 - Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System

B. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.

C. ASME A112.18.1 - Plumbing Supply Fittings

D. ASME A112.18.2 - Plumbing Waste Fittings

E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures

F. ASME A112.19.1 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures

G. ASME A112.19.2 - Ceramic Plumbing Fixtures

H. ASME A112.19.3 - Stainless Steel Plumbing Fixtures

I. ASME A112.19.7 - Hydromassage Bathtub Systems

J. NSF/ANSI 61 - Drinking Water System Components - Health Effects

K. ANSI Z358.1 - Emergency Eyewash and Shower Equipment

L. ASSE 1016 - Performance Requirements for Individual Thermostatic, Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.

M. ASSE 1037 - Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures

N. ADA (Americans with Disabilities Act)

O. TAS (Texas Accessibility Standards)

1.5 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B. Warranty: Warrant the work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or non-conforming materials and workmanship.

C. Defects shall include, but not necessarily be limited to, the following:

1. Noisy operation.
2. Noticeable deterioration of finish.
3. Leakage of water.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Submit product data under provisions of Division One.

C. Include component sizes, rough-in requirements, service sizes, finishes, materials, dimensions, performance information, and accessories.

D. Manufacturer’s Installation Instructions: Indicate assembly and support requirements.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Provide pre-printed operating and maintenance instructions for each item specified. Instruct and demonstrate the proper operation and maintenance to the Owner's designated representative.

1.8 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled specialties to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept specialties on site in original factory packaging. Inspect for damage. Damaged specialties shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on the Contract Documents.

B. Confirm and field coordinate that millwork is constructed with adequate provisions for the installation of counter top lavatories and sinks.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. GENERAL: Provide plumbing fixtures in accordance with manufacturer's recommendations and as indicated and scheduled on Drawings. Acceptable manufacturers of each fixture type are as indicated below.

1. Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise.
2. Fixture drilling shall match faucet spread and match any related trim and accessories.

B. WATER CLOSETS, URINALS, LAVATORIES (Vitreous China)

1. American Standard
2. Kohler
3. Zurn
4. Sloan
5. Toto

C. WATER CLOSETS, URINALS, LAVATORIES, COMBINATION UNITS (Stainless Steel, Security Fixtures)

1. Acorn
2. Willoughby

D. SINKS - COUNTER MOUNTED (Stainless Steel)

1. Elkay
2. Just
3. Moen Commercial

E. SINKS - FREESTANDING (Stainless Steel)

1. Elkay
2. Just
3. Advance Tabco
4. Amtekco Industries

F. BATHTUBS

1. American Standard
2. Kohler
3. Toto

G. SHOWER ENCLOSURES

1. Comfort Designs
2. Aquarius Bathware
3. Hamilton Bathware

H. SHOWER SYSTEMS these are typically modular, multi-station shower units, often surface mounted or freestanding column type

1. Acorn
2. Bradley
3. Symmons Commercial
4. Willoughby Industries

I. WASH FOUNTAINS AND SOLID SURFACE LAVATORY SYSTEMS

1. Acorn
2. Bradley
3. Willoughby Industries

J. LAUNDRY TUBS these are thermoplastic or molded stone type

1. Fiat
2. E.L. Mustee & Sons
3. Zurn

K. MOP SINKS

1. Stern-Williams
2. Fiat
3. E.L. Mustee & Sons

L. SERVICE SINKS (Enameled Cast Iron) these are traditional style, mounted off-the-floor, with a P-trap standard

1. American Standard
2. Kohler
3. CECO (Commercial Enameling Company)

M. EMERGENCY SAFETY FIXTURES

1. Bradley
2. Guardian
3. Chicago
4. Haws
5. Speakman
6. Stingray Systems

N. DRINKING FOUNTAINS AND WATER COOLERS

1. Halsey Taylor
2. Elkay
3. Haws
4. Oasis

2.2 FAUCETS, SUPPLIES, AND TRIM

A. GENERAL: Provide faucets, supplies, and trim in accordance with manufacturer's recommendations, as appropriate for fixtures to be served, and as indicated and scheduled on Drawings. Acceptable manufacturers for each type of appurtenance are as indicated below.

1. Flushometer flush rate shall match gallon-per-flush criteria of fixtures served.
2. Strainers shall be heavy cast brass chrome plated with matching grid type strainer, with or without overflow as required, 17 gauge seamless brass tailpiece of length determined by installation requirements. Provide complete with washers and brass locknut.
3. P-traps shall be 17 gauge seamless chrome plated brass, adjustable type. Provide complete with cleanout plug, chrome plated brass slip nuts, wall bend, and wrought brass escutcheon of depth determined by installation requirements.
4. Angle stops shall be lead-free commercial pattern chrome plated brass, quarter turn ball type with loose key handles. Provide complete with chrome plated copper supply risers and wrought brass escutcheon of depth determined by installation requirements.
5. Toilet seats shall be commercial grade and provided complete with stainless steel posts and self-sustaining check hinges.
6. Pipe trim insulation shall be compliant, white molded vinyl, fade/discoloration-resistant, bacteria/fungal-resistant insulation.

7. Where an exposed flush valve assembly will conflict with the installation height of a grab bar or where there will be insufficient clearance above the top cover of an exposed flush valve for maintenance access relative to the installation height of a grab bar, provide an offset type flush valve tube. Make adjustments as necessarytion and water rough-in as necessary for a compliant and functioning installation.

B. FAUCETS

1. Chicago
2. T&S Brass
3. Zurn
4. Moen Commercial
5. Delta Commercial
6. American Standard
7. Kohler
8. Symmons Commercial
9. Speakman

C. SHOWER VALVES

1. Acorn
2. Bradley
3. Symmons Commercial
4. Chicago
5. Powers
6. Zurn
7. Speakman

D. FLUSHOMETERS

1. Sloan
2. Zurn
3. Moen Commercial
4. Delta Commercial
5. American Standard
6. Toto

E. SUPPLY STOPS

1. McGuire
2. Zurn
3. Chicago

F. CHROME PLATED TUBULAR BRASS

1. McGuire
2. Zurn
3. Kohler

G. TOILET SEATS

1. Church
2. Bemis
3. American Standard
4. Zurn
5. Toto
6. Centoco

H. PIPE TRIM INSULATION

1. Truebro
2. McGuire
3. Plumberex

2.3 FIXTURE CARRIERS

A. GENERAL: ASME A112.6.1M; Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise. Fixture carrier foot supports shall be securely anchored to the floor with 1/2" bolts and anchors at all locations.

1. Chair type carriers shall be adjustable, with coated cast iron body with integral no hub waste and vent connections, complete with gasketed adjustable faceplate assembly, adjustable nipple with test cap, neoprene bowl gasket, lugs for floor and wall attachment, threaded fixture studs, and hardware. Provide single or double type of vertical or horizontal configuration as required and with auxiliary inlet as required.
2. Lavatory carriers shall be adjustable, with steel uprights and welded base feet, coated cast iron support brackets, cast or ductile iron concealed support arms, alignment rod, complete with leveling and support hardware. Provide single or back to back configuration as required.
3. Drinking fountain and urinal carriers shall be adjustable, with steel uprights and welded base feet, upper and lower bearing plates, threaded rods, and mounting hardware. Provide single or side-by-side configuration as required

B. ACCEPTABLE MANUFACTURERS

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam

PART 3 - EXECUTION

3.1 PREPARATION

A. EXAMINATION OF CONDITIONS: Examine conditions affecting this work. Report unsatisfactory conditions to the proper authority and do not proceed until those conditions have been corrected. Commencing work implies acceptance of existing conditions as satisfactory to the outcome of this work.

B. Coordinate cutting of floor construction to receive drains to required invert elevations.

3.2 INSTALLATION

A. Install fixtures in locations and heights as shown on Drawings and as directed by the Architect.

B. Install materials plumb, level, securely, and in accordance with manufacturer's recommendations.

C. All rough-in pipe openings for final connections with supply, waste, vent, and storm systems shall be closed with caps or plugs during early stages of construction and installation. Tape shall not be considered sufficient protection.

D. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

E. Provide ball valves in piping serving batteries of fixtures. Label stops "Hot" and "Cold." Valves shall be located above accessible ceilings. If ceilings are not accessible, provide access panels of adequate size to ensure valves are fully accessible and can be fully operated.

F. Provide lockable ball valves in piping serving emergency safety fixtures and clearly label such valves as to the fixtures served.

G. Plumbing fixtures shall be supported by a concealed carrier where required to properly support the fixture specified. All carriers to be securely mounted, bolted and checked prior to concealment.

H. Caulk around fixtures with best grade white silicone caulking. Do not use grout.

I. All handles on supply and drainage fittings or other brass items shall be properly lined up and adjusted. Fittings shall not be left in any haphazard manner.

J. All fixtures shall have individual chrome plated heavy pattern loose key quarter-turn cutoff stops on supply lines, complete with escutcheons. Where same are not specified as a part of the fixture trim, they shall be installed as close to fixtures as possible in the hot and cold water supply. A loose key for each stop shall be provided to the Owner.

K. Install each fixture with trap, easily removable for servicing and cleaning.

L. All showers and similar installations shall be installed with type “L” copper pipe between shower valve and shower head rough-in. The termination point shall have a brass drop ear elbow for shower head arm connection. Contractor shall provide proper anchoring support.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B. Review architectural drawings. Confirm configuration and orientation of shower controls and trim prior to rough-in and installation.

3.4 ADJUSTING

A. Adjust work under provisions of Division One.

B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.5 CLEANING

A. Clean work under provisions of Division One.

B. At completion clean plumbing fixtures and appurtenances.

3.6 PROTECTION OF FINISHED WORK

A. Protect finished Work under provisions of Division One.

B. Do not permit use of fixtures.

3.7 ADA ACCESSIBLE FIXTURES

A. At all locations required to be accessible, such fixtures, controls, and final installations shall comply with the requirements of ADA and any applicable state accessibility standards. Install fixtures to heights, indicated on architectural drawings.

B. All exposed water supply and drain pipes under accessible lavatories and sinks shall be insulated with securely fastened pipe trim insulation kits of the proper model for the fixtures specified.

C. Wall mounted drinking fountains and coolers which protrude into passages or corridor space, whether single or paired with an adjacent accessible fixture, shall be supplied with a matching skirt or apron to lower the underside clearance of the non-accessible fixture equal to that required for accessible fixture.

END OF SECTION

SECTION 22 61 00

COMPRESSED AIR SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 22 02 00 - Basic Materials and Methods for Plumbing shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. The scope of the work shall include the furnishing and complete installation of the system covered by this Section, with all appurtenances, ready for the Owner's use.

B. Include the following work in addition to items normally part of this Section:

1. Compressed air pipe and fittings.
2. Transitions, connectors, and valves.
3. Filters, regulators, pressure gauges.
4. Compressor and air dryer equipment.

C. Refer to Division 26 sections for the following work not covered by this Section, and coordinate accordingly.

1. Power supply wiring from power source to power connection on compressed air equipment. Include starters, disconnects, and required electrical devices, except where furnished or factory-installed by equipment manufacturer.
2. Interlock wiring between electrically-operated compressed air equipment units and between equipment and any field-installed control devices, except where factory-installed by equipment manufacturer.

D. Provide the following electrical work as part of this section, complying with requirements of Division 26 sections: Control wiring between field-installed controls, indicating devices, and unit control panels.

1.3 RELATED WORK

A. Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

C. Section 22 05 53 - Identification for Plumbing Piping and Equipment

1.4 REFERENCES

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

E. ASME B31.3 - Process Piping.

F. ASME B31.9 - Building Services Piping.

G. ASME BPVC - Boiler and Pressure Vessel Code.

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

I. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

J. ASTM A197/A197M - Standard Specification for Cupola Malleable Iron.

K. ASTM B32 - Standard Specification for Solder Metal.

L. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

N. CAGI - The Compressed Air and Gas Handbook.

O. CAGI 3075 - B19.1 - Safety Standard for Compressor Systems.

P. NSF 61 - Drinking Water System Components - Health Effects.

Q. NSF 372 - Drinking Water System Components - Lead Content.

R. ASME Section IX -Welding and Brazing Qualifications.

S. ASME B16.14 - Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads.

T. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.

U. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

V. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

W. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

X. AWS A5.8 -Specification for Filler Metals for Brazing and Braze Welding.

Y. AWS 5.31 - Specification for Fluxes for Brazing and Braze Welding.

Z. ASSE 1079 -Performance Requirements for Dielectric Pipe Unions.

1.5 QUALITY ASSURANCE

A. Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

B. Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

C. Foreign pipe, fittings or valves are unacceptable.

D. Codes and Standards:

1. ASME Compliance: Provide compressed air pressure vessels and relief valves in accordance with ASME BPVC; provide ASME Code Symbol Stamp.
2. ASME Compliance: Fabricate and install compressed air systems in accordance with ASME B31.3 and ASME B31.9.
3. CAGI Compliance: Fabricate and install compressed air systems in accordance with Compressed Air and Gas Institute Standards CAGI 3075 - B19.1.
4. UL Compliance: Provide electrical components which are UL listed and have UL label affixed.

1.6 SUBMITTALS

A. Submit under provisions of Division One.

B. Product Data: Submit manufacturer's technical product data for compressed air pipe and fittings, connectors, filters, regulators, equipment and tanks. Include installation instructions for filters, regulators, equipment and tanks.

C. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to equipment. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.7 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division One.

B. Record actual locations of valves.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division One.

B. Operation Data: Include manufacturers’ instructions, start-up data, and trouble-shooting check lists for compressors, tanks, air dryers, and regulators.

C. Maintenance Data: Include manufacturers' literature, cleaning and maintenance procedures, replacement parts lists, and repair data for compressors, tanks, air dryers, regulators, and filters. Include wiring diagrams for electrically powered equipment.

1.9 QUALIFICATIONS

A. Manufacturer: Company regularly engaged in the manufacture of compressed air systems equipment and products, of the types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer: Firm with at least 3 years of successful installation experience on projects with compressed air systems work similar to that required for the project.

1.10 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY: Deliver clearly labeled equipment, tanks, piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B. TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C. ACCEPTANCE: Accept equipment, tanks, and products on site in original factory packaging. Receive equipment, tanks, and valves on site in shipping containers with labeling in place. Inspect for damage. Damaged equipment, tanks, or valves shall not be acceptable.

D. STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

F. Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, CONNECTORS, AND VALVES

A. Pipe and fittings shall be:

1. Copper Tubing: ASTM B88, Type L, hard drawn.
2. Fittings: ASME B16.18, cast bronze or ASME B16.22 wrought copper alloy solder joint pressure fittings.
3. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.
4. Galvanized steel pipe: ASTM A53/A53M, schedule 40.
5. Fittings: ASME B16.3, ASTM A153/A153M hot-dip galvanized, ASTM A197/A197M malleable iron, minimum pressure class 150.

6. Joints: Threaded joints in accordance with the manufacturer's installation instructions and ASME B1.20.1. Thread sealant tape or compound shall be applied only on male threads and shall be approved, insoluble in water, and non-toxic.

B. Connectors at all piping to air compressors shall be:

1. Flexible metallic type (no rubber or plastic components) connectors, capable of compensating for lateral movement and vibration.
2. Suited for the maximum system operating pressure.
3. Manufactured complete with section of 300 series stainless corrugated steel hose with outer braid, with inlet and outlet connections as required based on equipment connection size.
4. Provided with double braid design to increase working pressure rating as necessary.
5. Metraflex Company SSTC series or approved equivalent.

C. Valves shall be:

1. Ball type, all bronze cast construction two-piece 600 psi body, blow-out proof stem, Teflon seated, lead-free, with stainless steel trim (including ball, stem, and valve handle). Threaded connections. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.
2. Basis of design (bronze valves):
   a. NIBCO T-585-66-LF (full port) for all sizes up through 2".
   b. NIBCO T-580-66-LF (conventional port) for sizes 2-1/2" and 3".
3. Valves 4" and larger shall be split body stainless steel construction, 275 psi cold working pressure, blow-out proof stem, PTFE seated, type 316 stainless steel trimmed, class 150, full port design with manual gear operator. NIBCO F-515-S6-F-66-FS.
4. Acceptable alternate manufacturers: Apollo, Milwaukee.

2.2 AIR DRYERS

A. Acceptable Manufacturers:

1. Ingersoll Rand
2. Champion
3. Gardner Denver
4. Quincy Compressor
5. Saylor-Beall

B. Unless indicated otherwise on the Drawings: Refrigerated type, floor mounted, electric-powered air dryer from the same manufacturer as the associated compressor unit and matched to the scheduled compressor capacity. Single point electrical connection, voltage indicated on Drawings.

2.3 APPURTENANCES

A. Provide in-line central system air filters (1 micron rating unless indicated otherwise on Drawings), suited for the system demand, complete with pressure gauge and isolation valves. Located both upstream and downstream of the air dryer.

B. Provide a regulator based, single point air system pressure controller, downstream of the final filter to adjust outgoing system pressure as indicated on the Drawings or as indicated by the Owner. Provide complete with pressure gauges on both sides of unit.

C. Provide final filter/regulators, each complete with isolation valve, drain valve, and quick connect fitting(s) at each general purpose air drop.

2.4 BASIC VIBRATION CONTROL

A. Provide heavy duty rubber vibration isolators beneath each air compressor unit complete with lag screws and other required hardware to mount the equipment to a concrete housekeeping pad in accordance with manufacturer's recommendations.

B. Provide spring type hanger accessories for air system piping hangers adjacent to the compressor for a distance of no less than 20 feet. Eaton B-Line B3262 series or equivalent.

C. General: Adhere to the requirements of Section 22 05 48.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. General requirements for piping:

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
2. Remove any scale, oil and dirt, on inside and outside, before assembly.
3. Prepare piping connections to equipment with flanges or unions.
4. Confirm pipe placement and elevation prior to any installation.
5. All piping shall be installed free of sags and bends.
6. Make branch connections from the top of the associated main.
7. Provide piping with 1% downward slope in the direction of flow
8. Provide a drip leg with drain valve at starting point of air system piping and provide auxiliary drain points as necessary (bottoms of risers and at low points).

B. General requirements for valves:

1. Install valves with stems upright or horizontal, not inverted.
2. Valves shall be line-sized unless specifically noted otherwise.
3. Provide clearance for access to valves and operable fittings. Valves that must be installed beyond reasonable reach shall be provided with a chain operator.
4. Provide access doors where valves and operable fittings are not otherwise accessible. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.

C. Install all materials in accordance with the manufacturer's published instructions.

D. Route piping in an orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on Drawings, and maintain gradients.

E. Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

F. Group piping whenever practical at common elevations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Support and label all piping, valves, and equipment in accordance with the requirements of related Sections.

I. Provide male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections

J. Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.

K. Route drain lines to approved disposal points or indirect waste receptors.

3.2 INSTALLATION OF EQUIPMENT

A. Ensure all compressed air equipment is provided with sufficient clearances for installation, operation, inspection, and maintenance and in accordance with manufacturer’s recommendations.

B. Provide 4” thick reinforced concrete housekeeping pad(s) for base-mounted equipment, to extend no less than 4” from equipment footprint on all sides. Cast anchor bolt inserts into pad(s).

C. Provide compressor air intake from the outside air, with open end of intake pipe well hooded and screened to prevent rain and dust or dirt from entering. Route intake piping full size and as short and direct as possible, with long radius elbows where bends are necessary. For long lengths of run, piping shall be upsized accordingly.

D. Intake pipe shall be located no less than 6 feet above ground and located clear from any exhaust outlets to prevent contamination.

E. Slope discharge piping away from the compressor with sufficient pitch to prevent either condensate or oil draining back into the compressor.

F. Provide union downstream of all valves at equipment or apparatus connections.

G. Electrical Wiring: Install electrical devices furnished by manufacturer but not provided factory-mounted. Furnish a copy of the manufacturer's wiring diagram submittal to the Electrical Installer.

H. Verify that electrical wiring installation is in accordance with the manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to the equipment installer.

3.3 CLEANING, TESTING, AND FIELD QUALITY CONTROL

A. Blow out the system piping to ensure it is clear and free of all foreign matter or installation residue prior to connecting equipment or filters.

B. Provide Architect/Engineer with reasonable advance notice of system testing, no less than 48 hours prior.

C. Piping system shall be tested for leaks and integrity with clean, dry air at 150% of the system working pressure (but in no case less than 150 psi) for no less than one hour, with no leakage detected. If leaks are present, they shall be repaired. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

D. Gauges for pressure testing shall be incremented for 2% or less of the required test pressure with a pressure range not exceeding twice the test pressure applied.

E. Start-up and test equipment for proper operation in accordance with manufacturer’s recommendations. Test all alarms for both high pressure and low pressure conditions.

F. Prior to turnover of the system to the Owner, ensure that all system filters are new and clean.

END OF SECTION

SECTION 23 02 00

BASIC MATERIALS AND METHODS FOR HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect/Engineer for review as soon as practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C. Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is the equivalent of that specified.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent drawings, including those of other contracts, prior to commencement of Work.

B. This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Mechanical (HVAC) items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. The Contractor shall participate in the commissioning process as required; including, but not limited to, meeting attendance, completion of checklists, and participation in functional testing.

1.3 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The Contract Documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed shop drawings.

B. All duct or pipe or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for review.

C. All transitions, offsets and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the Owner.

D. Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.4 SITE VISIT AND FAMILIARIZATION

A. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.5 WORK SPECIFIED IN OTHER SECTIONS

A. Finish painting is specified. Prime and protective painting are included in the work of this Division.

B. Owner and General Contractor furnished equipment shall be properly connected to Mechanical (HVAC) systems.

C. Furnishing and installing all required Mechanical (HVAC) equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.6 PERMITS, TESTS, INSPECTIONS

A. Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.7 DATE OF SUBSTANTIAL COMPLETION

A. The date of final acceptance shall be the date of substantial completion. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct - properly protected from incidental damage and weather damage.

C. Damaged equipment, duct or pipe shall be promptly removed from the site and new, undamaged equipment, pipe or duct shall be installed in its place promptly with no additional charge to the Owner.

1.9 NOISE AND VIBRATION

A. The heating, ventilating and air conditioning systems, and the component parts thereof, shall be guaranteed to operate without objectionable noise and vibration.

B. Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C. Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D. All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 DELEGATED DESIGN FOR ANCHORAGE OF ROOF MOUNTED EQUIPMENT

A. The Contractor shall engage a qualified professional engineer to design all roof mounted equipment curbs, equipment supports, equipment tie downs, equipment connections, and methods of attachment for components that are to be anchored to the building structure. The design shall comply with wind load and uplift requirements utilizing design criteria per ICC (IBC) and ASCE 7 unless criteria is otherwise indicated in the Construction Documents.

B. Submittal: Signed and sealed engineering analysis data and accompanying details, drawings, and supplemental installation information shall be submitted to the engineer for review.

1.11 APPLICABLE CODES AND STANDARDS

A. Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B. Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C. Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements which includes and is not limited to the following nationally accepted codes and standards:

1. Air Moving & Conditioning Association, AMCA.
2. American Standards Association, ASA.
3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
4. American Society of Mechanical Engineers, ASME.
5. American Society of Plumbing Engineers, ASPE.
6. American Society of Testing Materials, ASTM.
7. American Water Works Association, AWWA.
8. National Bureau of Standards, NBS.
9. National Fire Protection Association, NFPA.
10. Sheet Metal & Air Conditioning Contractors' National Association, SMACNA.

11. Underwriters' Laboratories, Inc., UL.
12. International Building Code, IBC.
13. International Energy Conservation Code, IECC.
14. International Fire Code, IFC.
15. International Fuel Gas Code, IFGC.
16. International Mechanical Code, IMC.

D. Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.

E. When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.12 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor, or its Subcontractor or Sub-subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor or, when so noted, by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by the latest ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.13 DRAWINGS AND SPECIFICATIONS

A. These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the Work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B. Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.

C. The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is the equivalent of the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturer's standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D. The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E. Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equivalent capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 calendar days prior to the bid date without fail.

F. Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G. Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equivalent construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H. Wherever a definite product, material or method is specified and there is a statement that "OR EQUIVALENT" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUIVALENT" product, material or method may be used if it complies with the Specifications and is submitted for review to the Engineer as outline herein.

I. Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) Design Documents and all other trades, including Division 26.

J. Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected Subcontractors shall be the responsibility of this bidder and not the Owner.

K. If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L. The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with the requirements listed above; and if accepted, will issue a letter allowing the substitutions.

M. Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with his trades and all other trades; and to pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.14 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty-day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.

3. A list of variations page with a listing of all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 00 and Division 01 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.

2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating that the submittal meets all conditions of the Contract Documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.
6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified. The Contractor will automatically be required to furnish the product, material or method named in the Specifications. Contractor shall not order equipment when submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without submittal review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Submittals are required for, but not limited to, the following items subject to project requirements:

1. Coordination Drawings
2. Common Motor Requirements for HVAC Equipment
3. Expansion Fittings and Loops for HVAC Piping
4. Variable Frequency Motor Speed Control for HVAC Equipment
5. Hangers and Support for Piping and Equipment HVAC
6. Vibration and Seismic Controls for HVAC Piping and Equipment

7. Testing, Adjusting, and Balancing
8. Duct Insulation
9. HVAC Equipment Insulation
10. HVAC Piping Insulation
11. Refrigerant Monitor System
12. Energy Management and Control System
13. Above Ground Hydronic Piping
14. Hydronic Specialties
15. Hydronic Pumps
16. Refrigerant Piping
17. Metal Ductwork
18. Ductwork Accessories
19. Duct Silencers
20. HVAC Fans
21. High-Volume Low-Speed Propeller Fans
22. Dust Collection Systems
23. Series Fan Powered Terminal Units
24. Single Duct VAV Terminal Box
25. Parallel Fan Powered Terminal Unit
26. Dual Duct Air Terminal Units
27. Air Distribution Devices
28. HVAC Gravity Ventilators
29. Air Filters
30. Air Purification Systems
31. Flue Pipe Systems
32. Non-Condensing Boilers
33. Condensing Boilers
34. Finned Water-Tube Boilers
35. Steel Water-Tube Boilers
36. Gas Fired Furnaces
37. Gas Fired Roof Mounted Make-up Air Unit Heaters
38. Shell and Tube Heat Exchanger
39. Plate-Type, Liquid-To-Liquid Heat Exchangers
40. Centrifugal Liquid Chiller
41. Rotary Screw Water Chillers
42. Air Cooled Rotary Liquid Chiller
43. Induced Draft Cooling Tower
44. Energy Recovery Ventilator
45. Modular Indoor Central Station Air Handling Units
46. Packaged Air Handling Unit
47. Modular Outdoor Central Station Air Handling Units
48. 100% Outside Air Rooftop Unit with Gas Heat
49. Self-Contained Air Conditioners
50. Rooftop Heating and Cooling Units Electric Cooling-Gas Heating
51. Rooftop Heating and Cooling Units Electric Cooling-Electric Heat
52. Variable Air Volume Rooftop Units
53. Split System Air-Conditioners - Wall-Mounted
54. Variable Refrigerant Flow (VRF) for HVAC System
55. Water Source Heat Pump Unit
56. Fan Coil Unit
57. Unit Ventilators
58. Electric Unit Heaters

59. Electric Duct Heaters
60. Radiant Heating Electric Cables
61. Air Conditioning Unit for Swimming Pool Enclosures

I. Refer to other Division 23 sections for additional submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.15 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
   a. Wall and type locations.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
   e. Equipment connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Routing of storm and sanitary sewer piping.
   h. Fire-rated wall and floor penetrations.
   i. Sizes and location of required concrete pads and bases.
   j. Valve stem movement.
   k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting coordination drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.16 RECORD DOCUMENTS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 23.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Record Drawings shall indicate, at a minimum, the following installed conditions:

1. Duct mains and branches, size and location, for both exterior and interior; locations of dampers, fire dampers, duct access panels, and other control devices; filters, fuel fired heaters, fan coils, condensing units, and roof-top A/C units requiring periodic maintenance or repair.
2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.
3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.
5. Contract Modifications, actual equipment and materials installed.

E. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F. If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G. The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____

(SIGNATURE)

1.17 OPERATING AND MAINTENANCE MANUALS

A. Prepare operating and maintenance manuals in accordance with Division 00 and Division 01 and, in addition to the requirements specified in those Divisions, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
   a. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
   b. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
   c. Servicing instructions and lubrication charts and schedules.

1.18 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled date for each test. This detailed completion and test schedule shall be submitted at least 90 days before the projected substantial completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of substantial completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to, those items outlined in Section 23 02 00.

1.19 OPERATING AND MAINTENANCE MANUALS

A. Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 23. In addition to the requirements of other Sections, this shall include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
8. Servicing instructions and lubrication charts and schedules.
9. Equipment and motor name plate data.
10. Wiring diagrams.
11. Exploded parts views and parts lists for all equipment and devices.
12. Color coding charts for all painted equipment and conduit.
13. Location and listing of all spare parts and special keys and tools furnished to the Owner.
14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B. Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow ¼” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Mechanical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 23 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C. In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E. Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.20 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include a minimum of 12 hours of onsite training in three (3) shifts of four (4) hours each.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 23 Sections for additional Operator Training requirements.

1.21 FINAL COMPLETION

A. At the completion of the Work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 23 for additional requirements.

B. Clean and adjust all air distribution devices and replace all air filters immediately prior to Substantial Completion.

C. Touch up and/or refinish all scratched equipment and devices immediately prior to Substantial Completion.

1.22 CONTRACTOR'S GUARANTEE

A. Use of the HVAC systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing; and, if granted, shall not cause the warranty period to start, except as defined below.

B. Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one year after the date of the Substantial Completion, and shall furnish (free of additional cost to the Owner) all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C. This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D. All air conditioning compressors shall have parts and labor guarantees provided by the equipment manufacturer for a period of not less than 5 years beyond the date of Substantial Completion.

E. Refer to Sections in Division 23 for additional guarantee or warranty requirements.

1.23 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B. Because data stored in electronic media format can deteriorate or be modified inadvertently, or otherwise, without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be at the Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with "Buy American Act."

B. Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.

C. All access doors located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.

D. Access Doors: shall be as follows:

1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surface: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install doors only in locations approved by the Architect.

2.2 EQUIPMENT PADS

A. Provide 6-inch-high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of 6 inch beyond the equipment on all sides. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

B. Provide 6-inch-high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of 6 inch beyond the equipment on all sides. Provide a 4-foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.1 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B. Refer to equipment specifications in Divisions 2 through 48 for additional rough-in requirements.

3.2 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as possible, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.
11. Install access doors where units are concealed behind finished surfaces. Refer to paragraph 2.1 in this section and architect for access doors specifications and location.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curbs which match the roof slope and provides a level top for equipment installation. Refer to Architectural drawings and details.
14. The equipment to be furnished under these Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.

15. The Architectural and Structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.
16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.
17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.
18. Identification of Mechanical Equipment:
    a. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.
    b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.
19. Provide construction filters for all air handling units, fan coil unit, VAV boxes, and all other air handling equipment during the entire construction period.
20. Provide temporary construction strains for all strainers in the hydronic systems during the initial flushing of the systems.

3.3 CUTTING AND PATCHING

A. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective Work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.
7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Paragraph 1.11 I for definition of "Installer."

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, mechanical ducts and HVAC units, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.4 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A. The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.
2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.
3. Contractor shall not start-up any of the HVAC equipment unless the Owner, Architect and Engineer are signed off.
4. Start-up for major HVAC equipment such as chillers, cooling towers, variable frequency drives and hot water boilers shall be performed by a factory technician. The start-up shall include a written report signed off by Contractor, Engineer and Owner.

3.5 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A. In the preparation of these documents every effort has been made to show the approximate locations of, and connections to, the existing piping, duct, equipment and other apparatus related to this phase of the Work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by the contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B. All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C. All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe and duct, pipe and duct hangers and/or line supports. Where duct or pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D. During construction and remodeling, portions of the Project shall remain in service. Construction equipment, material, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility; or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

E. Certain work during the demolition and construction phases may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

F. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

G. Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

H. Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

I. Include in the contract price all rerouting of existing pipe, duct, etc., and the reconnecting of the existing equipment as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, and ventilation services for the existing areas with a minimum of interruption.

J. All existing pipe, duct, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

K. Pipe, duct, equipment and controls serving mechanical and other Owner's equipment, etc., which is to remain but is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

L. No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner's representative in order to protect systems that shall remain in service.

M. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

N. Refer to Architectural Demolition and/or Alteration plans for actual location of walls, ceilings, etc., being removed and/or remodeled.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. WORK SPECIFIED ELSEWHERE:

1. Painting
2. Automatic temperature controls
3. Power control wiring to motors and equipment

1.3 WARRANTY

A. Warrant the Work specified herein for one year and motors for five years beginning on the date of substantial completion.

1.4 REFERENCE STANDARDS

A. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators.

B. NEMA MG 1 - Motors and Generators.

1.5 SUBMITTALS

A. SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.

C. MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.

D. Refer to Division One for additional information.

1.6 DELIVERY AND STORAGE

A. DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B. TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C. STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.1 ELECTRIC MOTORS

A. APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.

1. Baldor
2. Marathon
3. Siemens-Allis
4. General Electric
5. U.S. Motor

B. TEMPERATURE RATING: Provide insulation as follows:

1. CLASS B: 40 degrees C maximum.
2. CLASS F:
   a. Between 40 degrees C and 65 degrees C maximum.
   b. Totally enclosed motors.

C. STARTING CAPABILITY: As required for service indicated five starts minimum per hour.

D. PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.

1. UP TO 3/4 HP: Provide electronically commutated brushless DC single phase motors with built-in inverter and microprocessor-based control.
2. 1 HP AND LARGER: Provide squirrel-cage AC induction polyphase motors.
3. Name plate voltage shall be the same as the circuit's nominal voltage, serving the motor.

E. SERVICE FACTOR: 1.15 for polyphase; 1.35 for single phase.

F. FRAMES: U-frames 1.5 hp. and larger.

G. BEARINGS: Provide sealed re-greaseable ball bearings; with top mounted Zerk lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:

1. Design for thrust where applicable.
2. PERMANENTLY SEALED: Where not accessible for greasing.

3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional hp. motors or polyphase requiring minimum noise level.

H. ENCLOSURE TYPE: Provide enclosures as follows, except where otherwise indicated:

1. CONCEALED INDOOR: ODP (Open Drip Proof).
2. EXPOSED INDOOR: Guard Protected.
3. OUTDOOR TYPICAL: Type II. TEFC.
4. OUTDOOR WEATHER PROTECTED: Type I. WPI.
5. EXPLOSION PROOF, XP: For use in hazardous locations.

I. OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

J. NOISE RATING: "Quiet" except where otherwise indicated.

K. All motors that are to be operated by a variable frequency drive shall be inverter duty rated motors.

L. All motors operated by variable frequency drive shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings.

M. EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE 112, Method B, including stray load loss measure.

NEMA MG 1 Efficiency - 1800 RPM Synchronous Speed		
Motor horsepower	Index Letter	Minimum Efficiency
3 - 5	G	89.5
7.5	G	91.0
10	F	91.7
15 - 20	E	93.0
25 - 30	E	93.6
40	D	94.1
50	C	95.0
60	C	95.0
75	C	95.0
100 - 125	B	95.4
150 - 200	B	95.8

NEMA MG 1 Efficiency - 1200 RPM Synchronous Speed		
Motor horsepower	Index Letter	Minimum Efficiency
3 - 5	G	89.5
7.5	G	90.2
10	F	91.7
15	F	91.7
20	E	92.4
25 - 30	E	93.6
40 - 50	D	94.1
60	D	94.5
75	C	94.5
100 - 125	C	95.0
150 - 200	B	95.4

2.2 MOTOR CONTROLLERS (STARTERS)

A. All motor controllers (for equipment furnished under Division 23) shall be furnished under Division 23 and installed under Division 26 unless otherwise noted on the plans.

1. Starters shall be provided for 3 phase motors 1 horsepower and greater.

B. Motor starters shall be furnished as follows.

1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.
2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.
3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.
4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.
5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.

6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 23. Motor starter controls shall be mounted in the starter enclosure cover.
7. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.
8. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.
9. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.
10. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located by cooling towers.
11. POWER MONITOR: Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving all 3 phase motors. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.

1. Siemens.
2. Square D.
3. General Electric.
4. Eaton.

2.3 COMBINATION MOTOR STARTERS

A. GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.02-B, except as modified herein.

B. DISCONNECT SWITCH: Disconnect switches shall be as specified in Section 26 28 16.

C. APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturer's.

1. Siemens.
2. Square D.
3. General Electric.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturers' recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors' price shall include all items required as per manufacturers' requirements.

C. Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.

D. Install rotating equipment in static and dynamic balance.

E. Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.

F. Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION

SECTION 23 05 29

HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Pipe, and equipment hangers, supports and associated anchors.

B. Sleeves and seals.

C. Flashing and sealing equipment and pipe stacks.

1.3 RELATED WORK

A. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

B. Section 23 07 16 - HVAC Equipment Insulation

C. Section 23 07 19 - HVAC Piping Insulation

D. Section 23 21 13 - Above Ground Hydronic Piping

E. Section 23 21 16 - Underground Hydronic Piping

1.4 REFERENCES

A. ASME B31.1 - Power Piping.

B. ASME B31.9 - Building Services Piping.

C. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

1.5 QUALITY ASSURANCE

A. Hangers and Supports for HVAC Piping: In conformance with ASME B31.1 and ASME B31.9.

B. Hangers and Supports for HVAC Piping: In conformance with MSS SP-58.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Indicate hanger and support framing and attachment methods.

C. Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipes Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipes Sizes 2 to 4 Inch: Carbon steel, adjustable clevis.

C. Hangers for Pipes Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roller, double hanger.

D. Multiple or Trapeze Hangers: Steel channels with welded spacers, pre-formed manufactured saddles and hanger rods; cast iron roller and stand for pipe sizes 6 inches and over.

E. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F. Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roller.

G. Vertical Support: Steel riser clamp.

H. Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I. Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roller and stand, steel screws, and concrete pier or steel support.

J. Roof Pipe Supports and Hangers: Galvanized Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.

1. For pipes 2-1/2” and smaller - Type PP10 with roller
2. For pipes 3” through 8” - Type PS
3. For multiple pipes - Type PSE - Custom

K. Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal. Hangers: Plastic coated; Unistrut or equal.

L. Shields for Vertical Copper Pipe Risers: Sheet lead.

M. Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief “Pipe Titan” or equal.

2.2 HANGER RODS

A. Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case with 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.

2.4 FLASHING

A. Metal Flashing: 20 gage galvanized steel.

B. Lead Flashing: 4 lb. /sq. ft. sheet lead for waterproofing; 1 lb. /sq. ft. sheet lead for soundproofing.

C. Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

D. Coordinate with roofing contractor/Architect for type of flashing on metal roofs.

2.5 EQUIPMENT CURBS

A. Fabricate curbs of hot dipped galvanized steel.

B. For metal roof construction, roof curbs shall be made of aluminum or stainless steel. Coordinate with Architectural Drawings and details.

2.6 SLEEVES

A. Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.

B. Sleeves for Pipes through Beams, Interior Walls, Exterior Walls, Footings, and Potentially Wet Floors: Form with steel pipe, Schedule 40, galvanized.

C. Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed, manufactured by Hilti.

D. Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.

E. Caulk: Paintable 25-year acrylic sealant.

F. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.7 MECHANICAL SLEEVE SEALS

A. Modular sealing element unit, designed for field assembly, to continuously fill annular space between pipe and sleeve and create watertight seal.

1. Approved Manufacturers:
   a. Link-Seal by Garlock Pipeline Technologies (GPT)
   b. Innerlynx by Advance Products & Systems, Inc.
   c. MetraSeal by Metraflex Co.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material, size of pipe, and service requirements.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.8 FABRICATION

A. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B. Design hangers without disengagement of supported pipe.

C. Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.9 FINISH

A. Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with Structural Engineer for placement of inserts.

B. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C. Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D. Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with Structural Engineer prior to start of work.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"

(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron Pipe)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 inch and over	4'-0"	5/8"

B. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C. Place a hanger within 12 inches of each horizontal elbow, and at the vertical to horizontal transition.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor.

G. For vertical shaft or chase applications where floor slab supported riser clamps cannot be provided to keep the pipe in alignment and to support the weight of the pipe and its contents, ensure to provide suitable fasteners, hardware, braces, unistrut, structural steel members, and appurtenances required to accommodate the pipe installation. Coordinate all such work with the project structural engineer to ensure that necessary members and attachment points are provided accordingly to bear the weight of the functioning piping.

H. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

I. Support riser piping independently of connected horizontal piping.

J. Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

K. Portable pipe hanger systems shall be installed per manufacturer’s instructions.

L. Distances between supports are maximum distance. Supports shall be provided to carry the pipe/equipment load.

3.3 INSULATED PIPING

A. Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B. Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation. Secure the full contact area of the saddle to the pipe insulation with 1/8" thick coat of mastic.

C. Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Secure the full contact area of the shield to the pipe insulation with 1/8" thick coat of mastic.

D. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

Nominal Pipe Size	Shield Length	Gauge Thickness
1/4 through 3-1/2 inch	12	18
4 inch	12	16
5 through 6 inch	18	16
8 through 14 inch	24	14
16 through 24 inch	24	12

E. Piping 2" and larger: provide galvanized sheet metal shields with calcium silicate insulation at hangers/supports.

F. Insert material shall be at least as long as the protective shield.

G. Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.4 EQUIPMENT BASES AND SUPPORTS

A. Provide equipment bases of concrete.

B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

D. Construct support of steel members. Brace and fasten with flanges bolted to structure.

E. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

A. Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Provide curbs for mechanical roof installations that extend minimum 8 inches above adjacent roofing surface. Contact Architect for all flashing details and roof construction. Seal penetrations watertight.

3.6 SLEEVES

A. Sleeves shall be provided at the following locations:

1. Piping passing through rated and non-rated floor assemblies, rated ceiling assemblies, and roof assemblies.
2. Piping passing through concrete, masonry, and rated gypsum board walls and partitions.
3. Piping passing through exterior wall assemblies above and below grade.
4. Piping passing through non-rated gypsum board walls and partitions where indicated on the drawings or where exposed to view.
5. Piping passing through structural members where indicated on the drawings or where exposed to view.
6. Any other locations indicated on the drawings.

B. Set sleeves in position in formwork. Provide reinforcing around sleeves.

C. Extend sleeves through floors minimum one inch above finished floor level. Sleeves located in walls, ceilings, and structural members shall be flush with the outer surfaces of the assembly being penetrated.

D. Where sleeved piping penetrates a floor, ceiling, or interior wall assembly, pack annular space between pipe and sleeve with UL listed fire stopping insulation and caulk seal airtight with fire barrier sealant. Provide close fitting metal collar or escutcheon covers at both sides of wall penetrations and exposed side of ceiling penetrations.

E. Install all UL listed, prefabricated fire rated steel sleeves per the manufacturer's installation instructions to ensure fire rating is maintained.

F. Sleeves at exterior walls below grade shall be sealed with mechanical sleeve seal. Install seal per manufacturer's installation instructions. Select type and number of sealing elements required for pipe material, pipe size, and service requirements. Position pipe in center of sleeve. Assemble mechanical sleeve seal and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal. Locations above grade shall be provided with close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Vibration and sound control products.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria curves for all equipment at full load conditions.

C. Unless otherwise indicated, sound and vibration control products shall be provided by a single manufacturer.

1.4 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. VMC Group

B. Mason Industries, Inc.

C. Kinetics Noise Control, Inc.

D. Vibration Eliminator Co., Inc.

2.2 GENERAL

A. Provide vibration isolation supports for equipment, piping and ductwork, to prevent transmission of vibration and noise to the building structure that may cause discomfort to the occupants.

B. Model numbers of VMC Group products are included for identification. Products of the listed manufacturers will be acceptable provided they comply with all the requirements of this specification.

2.3 FLOOR MOUNTED AIR HANDLING UNITS AND ENERGY RECOVERY UNITS

A. Provide VMC Group model CAL-2 aluminum housed isolators sized for 2” static deflection. Cast iron or steel housings may be used provided they are hot-dip galvanized after fabrication.

B. If floor mounted air handling units are furnished with internal vibration isolation option, provide VMC Group model SP-NRC, style E, consisting of two layers of 1" thick ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate to address high frequency breakout and afford additional unit elevation for condensate drains. Ribbed elastomeric pads shall be located in accordance with the air handling unit manufacturer’s recommendations.

2.4 SUSPENDED AIR HANDLING UNITS AND ENERGY RECOVERY UNITS

A. Provide VMC Group model HRS-2 combination spring and elastomeric isolation hanger sized for 2’’ static deflection.

B. If suspended air handling units are furnished with internal vibration isolation option, provide VMC Group model HR elastomeric isolation hangers sized for approximately ½’’ deflection to address high frequency break-out.

2.5 SUSPENDED FANS AND FAN COIL UNITS

A. Provide VMC Group model HS spring hangers sized for 1’’ static deflection.

condensing units

B. Provide VMC Group model NRC, 1" thick ribbed elastomeric isolation pads sized for approximately 40 psi loading and 1/8’’ deflection.

C. Pads shall be located in accordance with the condensing unit manufacturer’s recommendations.

2.6 PIPING

A. Provide VMC Group model HRS-1 combination spring and elastomeric isolation hangers sized for 1" deflection in mechanical equipment rooms, for a minimum distance of 50 feet from isolated equipment for all chilled water and hot water piping 1-1/2’’ diameter and larger.

B. Floor supported piping is required to be isolated with VMC Group model AW-1 open springs sized for 1'' deflection.

C. All condenser water piping shall be supported with VMC Group model AW-1 open springs sized for 1" deflection for floor or roof mounted piping and VMC Group model HRS-1 combination spring and elastomeric isolation hangers sized for 1" deflection for suspended piping.

D. Provide line size flexible connectors at supply and return of pumps and all other locations indicated on the mechanical drawings and details. Flexible pipe connectors shall be VMC Group model 2800 single sphere EPDM construction and shall include 150 lb. cadmium plated carbon steel floating flanges.

2.7 CORROSION PROTECTION

A. All vibration isolators shall be designed and treated for resistance to corrosion.

B. Steel components: PVC coated or phosphate coated and painted with industrial grade enamel. Nuts, bolts, and washers: zinc-electroplated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C. If internal isolation option is used on air handling units, the mechanical contractor shall verify proper adjustment and operation of isolators prior to start-up. All shipping brackets and temporary restraint devices shall be removed.

D. The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B. Refer to Architectural Sections for additional requirements.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems.

PART 2 - PRODUCTS

2.1 VALVE AND PIPE IDENTIFICATION

A. Valves:

1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.
2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.
3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.
4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.

B. Pipe Marking:

1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.

2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton (Name plate Company Factory location 20 Thompson Road, Branford, Connecticut) or approved equal.
3. Generally, markers shall be located on each side of each and every partition, on each side of every tee, on each side of every valve and/or valve group, on each side of every piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.
4. Provide pipe markers that meet labeling requirements of ASME A13.1 for all refrigerant piping located in areas other than the room or space where the associated equipment is located. Pipe markers shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation. The minimum height of the identification lettering shall be 1/2". The pipe identification shall indicate the refrigerant designation and safety group classification of the refrigerant used in the piping system. For Group A2, A3, B2, and B3 refrigerants, the identification shall also include the following statement: “DANGER – Risk of Fire or Explosion. Flammable Refrigerant.” For any Group B refrigerant, the identification shall also include the following statement: “DANGER – Toxic Refrigerant”.
5. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.
6. Markers shall be colored as indicated below per ASME A13.1.

SYSTEM	COLOR	LEGEND
Chilled Water	Green	Chilled Water Supply; Chilled Water Return
Hot Water	Reddish Orange	Hot Water Supply; Hot Water Return
Condenser Water	Green	Condenser Water Supply; Condenser Water Return
Compressed Air	Blue	Compressed Air
Pneumatic Control	Yellow	Pneumatic Controls
Oxygen	Yellow	Oxygen
Nitrogen	Green	Nitrogen
Deionized Water	Green	Deionized Water
Steam	Yellow	Steam Supply; Steam Return

C. Pipe Painting:

1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior to installation.
2. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

SYSTEM	COLOR
Condenser Water Supply and Return	Light Green
Chilled Water Supply and Return	Light Blue
Heating Hot Water Supply and Return	Reddish Orange

2.2 EQUIPMENT IDENTIFICATION

A. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal with minimum 1/2 inch high letters manufactured by Seton Company or approved equal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All labeling equipment shall be installed as per manufacturer's printed installation instructions.

B. Provide printable label on ceiling grids and access doors at all locations that provide access to mechanical equipment, valves, motorized dampers, and accessories located above ceiling. The label shall be white with black text with 1/4 inch high letters and shall identify the component that is accessible at that location.

C. Provide printable label on ceiling grids and access doors at all locations that provide access to fire dampers, smoke dampers, and combination fire/smoke dampers located above ceiling. The label shall be white with red text with 1/2 inch high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, or FIRE DAMPER to identify the damper type that is accessible at that location.

D. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor's price shall include all items required as per manufacturer's requirements.

E. All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Refer to Division 9 for Architect's required paint system(s).

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 RELATED DOCUMENTS

A. Approved submittal date on equipment installed, to accomplish the test procedures, outlined under paragraph 3.01 of this Section, will be provided by the Contractor.

1.3 DESCRIPTION

A. The TAB of the air conditioning systems shall be performed by an impartial technical firm hired by the Contractor whose operations are limited only to the field of professional TAB. The TAB work will be done under the direct supervision of a qualified engineer employed by the TAB firm.

B. The TAB firm will be responsible for inspecting, adjusting, balancing, and logging the date on the performance of fans, dampers in the duct system, and air distribution devices. The Contractor and the various Subcontractors of the equipment installed shall cooperate with the TAB firm to furnish necessary data on the design and proper applications of the system components and provide labor and material required to eliminate deficiencies or malperformance.

1.4 QUALITY ASSURANCE

A. QUALIFICATIONS OF CONTRACTOR PERSONNEL: Submit evidence to show that the personnel who shall be in charge of correcting deficiencies for balancing the systems are qualified. The Owner and Engineer reserve the right to require that the originally approved personnel be replaced with other qualified personnel if, in the Owner and Engineer's opinion, the original personnel are not qualified to properly place the system in condition for balancing.

B. QUALIFICATIONS OF TAB FIRM PERSONNEL:

1. A minimum of one registered Professional Engineer licensed in the State, is required to be in permanent employment of the firm.
2. Personnel used on the jobsite shall be either Professional Engineers or technicians, who shall have been permanent, full time employees of the firm for a minimum of six months prior to the start of Work for that specified project.

3. Evidence shall be submitted to show that the personnel who actually balance the systems are qualified. Evidence showing that the personnel have passed the tests required by the Associated Air Balance Council (AABC) shall be required.

C. CALIBRATION LIST: Submit to the Engineer for approval, a list of the gauges, thermometers, velometer, and other balancing devices to be used in balancing the system. Submit evidence to show that the balancing devices are properly calibrated before proceeding with system balancing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SERVICES OF THE CONTRACTOR

A. The Drawings and Specifications have indicated valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions. Install these devices in a manner that leaves them accessible, and provide access as requested by the TAB firm.

B. Have systems complete and in operational readiness prior to notifying the TAB firm that the project is ready for their services, and certify in writing to the Architect and Owner that such a condition exists.

C. As a part of the Work of this Section, make changes in the sheaves, belts, and dampers or the addition of dampers required for correct balance of the new work as required by the TAB firm, at no additional cost to the Owner.

D. Fully examine the existing system to be balanced, to determine whether or not sufficient volume dampers, balancing valves, thermometers, gauges, pressure and temperature taps, means of reading static pressure and total pressure in duct systems, means of determining water flow, and other means of taking data needed for proper water and air balancing are existing. Submit to the Engineer in writing a listing of omitted items considered necessary to balance existing systems. Submit the list and proposal as a cost add item.

E. Verify that fresh air louvers are free of blockage, coils are clean and fresh air ducts to each air handling unit have individually adjustable volume regulating dampers.

F. Provide, correct, repair, or replace deficient items or conditions found during the testing, adjusting, and balancing period.

G. In order that systems may be properly tested, balanced, and adjusted as specified, operate the systems at no expense to the Owner for the length of time necessary to properly verify their completion and readiness for TAB period.

H. Project construction schedules shall provide time to permit the successful completion of TAB services prior to Substantial Completion. Complete, operational readiness, prior to commencement of TAB services, shall include the following services of the Contractor:

1. Construction status of building shall permit the closing of doors, windows, ceilings installed and penetrations complete, to obtain project operating conditions.
2. AIR DISTRIBUTION SYSTEMS:

a. Verify installation for conformity to design. Supply, return, and exhaust ducts terminated and pressure tested for leakage as specified.
b. Volume and fire dampers properly located and functional. Dampers serving requirements of minimum and maximum outside air, return and relief shall provide tight closure and full opening, smooth and free operation.
c. Supply, return, exhaust and transfer grilles, registers and diffusers shall be installed.
d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and sealed to eliminate excessive bypass or leakage of air.
e. Fans (supply and exhaust) operating and verified for freedom from vibrations, proper fan rotation and belt tension; overload heater elements shall be of proper size and rating; record motor amperage and voltage and verify that these functions do not exceed nameplate ratings.
f. Furnish or revise fan drives or motors as necessary to attain the specified air volumes.

3. WATER CIRCULATING SYSTEMS:
a. Position valves pertinent to system design and require operation to permit full flow of water through system components. Operate hydronic systems under full flow conditions until circulating water is clean. Remove and clean strainers as required during this cycle of operation.
b. For retrofit projects, record each existing pump motor amperage and voltage. Readings shall not exceed nameplate rating.
c. Verify, on new equipment, electrical starter overload heater elements to be of proper size and rating.
d. Ensure that water circulating systems shall be full of water and free of air; expansion tanks set for proper water level, and air vents installed at high points of systems and operating freely. Advise Engineer of deficiencies.
e. Check and set operating temperatures of heat exchangers to design requirements.
f. The various existing water circulating systems shall be cleaned, filled, purged of air, and put into operation before hydronic balancing.

4. AUTOMATIC CONTROLS:
a. Verify that control components are installed in accordance with project documents and functional, electrical interlocks, damper sequences, air and water resets, fire and freeze stats.
b. Controlling instruments shall be functional and set for design operating conditions. Factory precalibration of room thermostats and pneumatic equipment will not be acceptable.
c. The temperature regulation shall be adjusted for proper relationship between the controlling instruments and calibrated by the TAB Contractor. Advise Engineer of deficiencies or malfunctions.

I. Contractor shall repair any insulation removed from piping system by TAB Contractor during water balancing.

3.2 SERVICES OF THE TAB FIRM

A. The TAB firm will act as liaison between the Owner, Engineer, and the Contractor and inspect the installation of mechanical piping system, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems being retrofitted, repaired, or added under this Contract. The reinspection of the Work will cover that part related to proper arrangement and adequate provision for the testing and balancing and will be done when the Work is 80 percent complete.

B. Upon completion of the installation and start-up of the mechanical equipment, to check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building. Prepare and submit to the Engineer complete reports on the balance and operations of the systems.

C. Measurements and recorded readings of air, water, and electricity that appear in the reports will be done by the permanently employed technicians or engineers of the TAB firm.

D. Make an inspection in the building during the opposite season from that in which the initial adjustments were made. At the time, make necessary modifications to the initial adjustments required to produce optimum operation of system components to affect the proper conditions as indicated on the Drawings. At time of opposite season check-out, the Owner's representative will be notified before readings or adjustments are made.

E. In fan systems, the air quantities indicated on the Drawings may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the Contractor to furnish or revise fan drive and motors if necessary, without cost to the Owner, to attain the specified air volumes.

F. Contractor shall utilize ultrasonic flow meter to balance water flow of existing water system if the original pressure drop data is not available. Contractor shall remove insulation as necessary to use flow meter.

G. Participate in the commissioning process, which shall include but not be limited to attending commissioning meetings, coordinating work with and completing checklists as required by the commissioning team.

3.3 PROFESSIONAL REPORT

A. Before the final acceptance of the report is made, the TAB firm will furnish the Engineer the following data to be approved by the Owner and Engineer:

1. Summary of main supply, return and exhaust duct pitot tube traverses and fan settings indicating minimum value required to achieve specified air volumes.
2. A listing of the measured air quantities at each outlet corresponding to the temperature tabulation as developed by the Engineer and TAB firm.
3. Air quantities at each return and exhaust air handling device.
4. Static pressure readings entering and leaving each supply fan, exhaust fan, filter, coil, balancing dampers and other components of the systems. Including the retrofit Work. These readings will be related to performance curves in terms of the CFM handled if available.

5. Motor current readings at each equipment motor on load side of capacitors. The voltages at the time of the reading shall be listed.
6. The final report shall certify test methods and instrumentation used, final velocity reading obtained, temperatures, pressure drops, RPM of equipment, amperage of motors, air balancing problems encountered, recommendations and uncompleted punch list items. The test results will be recorded on standard forms.
7. A summary of actual operating conditions shall be included with each system outlining normal and ventilation cycles of operation. the final report will act as a reference of actual operating conditions for the Owner's operating personnel.

3.4 BALANCING AIR CONDITIONING SYSTEM

A. GENERAL:

1. Place all equipment into full operation, and continue operating during each working day of balancing and testing. If the air conditioning system is balanced during Off-Peak cooling season Contractor shall return to rebalance air side system as required to put system in proper balance at that season.
2. The Contractor shall submit detailed balancing and recording forms for approval. After approval by the Engineer, prepare complete set of forms for recording test data on each system. All Work shall be done under the supervision of a Registered Professional Engineer. All instruments used shall be accurately calibrated to within 1% of scale and maintained in good working order.
3. Upon completion of the balancing and testing, the TAB Contractor shall compile the test data in report forms, and forward five copies to the Engineer for evaluation.
4. The final report shall contain logged results of all tests, including such data as:
   a. Tabulation of air volume at each outlet.
   b. Outside dry bulb and wet bulb temperature.
   c. Inside dry bulb and wet bulb temperatures in each conditioned space room or area.
   d. Actual fan capacities and static pressures. Motor current and voltage readings at each fan.

B. AIR SYSTEMS: Perform the following operations as applicable to balance and test systems:

1. Check fan rotation.
2. Check filters (balancing shall be done with clean filters).
3. Test and adjust blower rpm to design requirements.
4. Test and record motor full load amperes.
5. Test and record system static pressures, suction and discharge.
6. Test and adjust system for design cfm, return air and outside air (±2%). Change-out fan sheaves as required to balance system.
7. Test and record entering air temperatures, db and wb.
8. Test and record leaving air temperatures, db and wb.
9. Adjust all zones to design cfm (±2%).
10. Test and adjust each diffuser, grille, and register to within 5% of design.

C. AIR DUCT LEAKAGE: (From SMACNA Duct Standards latest edition) Test all ductwork (designed to handle over 1000 CFM) as follows:

1. Test apparatus

a. The test apparatus shall consist of:
b. A source of high pressure air - a portable rotary blower or a tank type vacuum cleaner.
c. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

2. Test Procedures
   a. Test for audible leaks as follows:
      1) Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.
      2) Start the blower with its control damper closed.
      3) Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.
      4) Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.
   b. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
      1) Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.
      2) Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.
      3) Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
      4) Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which must be corrected.

D. DX SYSTEMS:

1. Test and record suction and discharge pressures at each compressor and record ambient air temperature entering the condensing coils.
2. Test and record unit full load amps and voltage.
3. Test and record staging and unloading of unit required by sequence of operation or drawing schedule.

E. Automatic temperature controls shall be calibrated; and all thermostats and dampers adjusted so that the control system is in proper operating condition, subject to the approval of the Engineer/Owner.

F. The TAB Contractor shall report to Engineer all air distribution devices or other equipment that operate noisily so that corrective measures may be implemented by the Contractor at no additional cost to the Owner or Architect/Engineer.

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Ductwork system insulation.

1.3 RELATED SECTIONS

A. Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

B. Section 23 05 53 - Identification for HVAC Piping and Equipment

C. Section 23 31 13 - Metal Ductwork

1.4 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

C. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation.

E. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C.

F. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

G. ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

J. ICC (IECC) - International Energy Conservation Code.

K. NAIMA FGDLS - North American Insulation Manufacturers Association (NAIMA) Fibrous Glass Duct Liner Standards.

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

N. SCAQMD 1168 - Adhesive and Sealant Applications.

O. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

P. UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance From Various Sources Using Static Environmental Chambers.

Q. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.5 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.

1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

C. Duct and plenum insulation shall comply with minimum R-value requirements of ICC (IECC) and ASHRAE Std 90.1 I-P unless greater values are indicated otherwise in the contract documents.

D. Adhesive and other material shall comply with NFPA 90A and NFPA 90B. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

E. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or polybrominated diphenyl ether fire retardants.

F. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

1.6 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective, or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.7 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer's stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

A. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

B. A sample quantity of each type of insulation and each type of application shall be installed and approval secured prior to proceeding with the main body of the Work.

2.2 ACCEPTABLE MANUFACTURERS

A. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Certain-Teed, Johns-Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer.

B. Adhesives shall be as manufactured by 3M Company, Arabol, Benjamin-Foster, Armstrong or Insulmastic, Inc., and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C. Ceramic fiber materials shall be as manufactured by Primer Refractories, A.P. Green Refractories or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. To ensure that it will achieve its highest possible performance and serve its intended purpose, install duct insulation and all associated accessories in accordance with the manufacturer's published instructions and industry standard practices detailed by NAIMA FGDLS and SMACNA (DCS).

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.2 EXTERNAL DUCT INSULATION

A. Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide apply as above and hold insulation in place on bottom side with mechanical pins and clips on 12" centers.

B. Seal all joints, fastener penetrations and other breaks in vapor barrier with 3-inch wide strips of white glass fabric embedded between two coats of vapor barrier mastic. Vapor barrier mastic shall be Childers CP-33 or approved equal for ductwork located indoors and shall be Childers CP-35 or approved equal for ductwork located outdoors.

C. All external duct insulation shall be Knauf Insulation Atmosphere Duct Wrap with ECOSE Technology, Johns Manville Microlite duct wrap insulation with FSK facing or approved equal.

D. External duct wrap is required on all outside air ducts, supply and return air ducts that are not internally insulated. External duct wrap is also required on all exhaust and relief air ducts that are used in airside energy recovery systems. Any exhaust ductwork located in an unconditioned space that conveys air from conditioned spaces or vice versa shall also be provided with external duct wrap. Duct wrap shall be provided as follows:

1. 1½" thick, 1.0 pcf density minimum; minimum installed R-value of 4.5 when ducts are located in directly conditioned spaces.
2. 2" thick, 1.0 pcf density minimum; minimum installed R-value of 8.0 when ducts are located in indirectly conditioned spaces such as ceiling plenum space used for return air or located indoors concealed within chases or shafts.
3. 3" thick, 0.75 pcf density minimum; minimum installed R-value of 8.0 when ducts are located in unconditioned spaces.

E. Any ductwork located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of duct wrap to establish a noncombustible rating per ASTM E136. Duct wrap products which are approved for such non-compliant combustible duct materials located in air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer's instructions.

3.3 DUCT LINER

A. Duct liner shall be kept clean and dry during transportation, storage, installation, and throughout the construction process care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.

B. All portions of duct designed to receive duct liner shall be completely covered with liner as specified. The smooth, black, mat facing or acrylic-coated surfaces with flexible glass cloth reinforcement shall face the airstream. All duct liner shall be cut to assure tight, overlapped corner joints. The top pieces shall be supported by the sidepieces. Duct liner shall be installed following the guidelines in the NAIMA FGDLS.

C. The duct liner shall be tested according to erosion test method in ASTM C1071 and shall be guaranteed to withstand velocities in the duct system up to 6,000 fpm without surface erosion.

D. Duct liner shall be adhered to the sheet metal with full coverage of an approved adhesive that conforms to ASTM C916, and all exposed leading edges and transverse joints shall be coated with Permacote factory-applied or field-applied edge coating and shall be neatly butted without gaps. Shop or field cuts shall be liberally coated with Johns Manville SuperSeal® duct butter and Edge Treatment or approved adhesive.

E. Metal nosings shall be securely installed over transversely oriented liner edges facing the airstream at forward discharge and at any point where lined duct is preceded by unlined duct.

F. When velocity exceeds 4,000 fpm (20.3 m/sec), use metal nosing on every leading edge. Nosing may be formed on duct or be channel or zee attached by screws, rivets or welds.

G. The liner shall further be secured with Graham welding pins and washers on not more than 18 inch centers both vertical and horizontal surfaces, and the pins and washers shall be pointed up with adhesive.

H. Duct liner shall be Knauf Insulation Atmosphere Duct Liner with ECOSE Technology, Johns Manville Linacoustic RC duct liner with factory-applied edge coating and acrylic coating on the mat surface of airstream side or approved equal. The liner shall meet the Life Safety Standards as established by NFPA 90A and NFPA 90B, FHC 25/50 and Limited Combustibility and the air stream surface coating should contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21. The duct liner shall conform to the requirements of ASTM C1071, UL 2824, with an NRC not less than 0.70 as tested per ASTM C423 using a Type “A” mounting, and a thermal conductivity no higher than 0.24 BTU*in/(hr*ft^2*°F) at 75°F mean temperature.

I. Line supply and return ductwork at connection of fan-powered HVAC units to a point of 15 feet upstream and downstream of the equipment, 15 feet downstream of fan powered terminal units, and in return air boots. Attach with full cover coat of cement, duct dimensions up to 16 inches; provide stick clips or screws and cap for dimensions over 16 inches, spaced 16 inches o.c. maximum. Provide sheet metal liner cap over all leading edges of internal insulation exposed to air stream.

J. Duct liner shall be provided as follows:

1. 1” thick, 1.5 pcf density minimum, with a minimum installed R-value of 4.2 when ducts are located in directly conditioned spaces.
2. 1 ½” thick, 1.5 pcf density minimum, with a minimum installed R-value of 6.0 when ducts are located in indirectly conditioned spaces such as ceiling plenum space used for return air.
3. 2” thick, 1.5 pcf density minimum, with with a minimum installed R-value of 8.0 when ducts are located in indoor, unconditioned spaces or located outdoors.

3.4 EXPOSED DUCTWORK LOCATED INDOORS

A. Duct required to be insulated by any section of this specification that is routed exposed in occupied spaces shall be double wall.

B. Duct routed exposed shall be double wall with perforated inner liner and glass mineral wool insulation. Provide 1” thick insulation when ductwork is located in conditioned spaces and 2” thick in unconditioned spaces, insulation density shall be a minimum of 1.0 PCF. Double wall duct shall be United McGill model Acousti-k27 for round or oval ducts and Rectangular-k27 for rectangular ducts or approved equal.

3.5 EXPOSED DUCT LOCATED OUTDOORS

A. All metal ductwork located outdoors shall be internally lined with fiberglass Duct Liner as specified and externally insulated with 2" thick, 6.0 pcf density fiberglass Insulation Board with FSK facing. The protective finish system shall be 0.016” minimum thickness aluminum jacketing.

B. Paint non-insulated duct. Coordinate color with Architect.

3.6 AIR DEVICE AND MISCELLANEOUS DUCT INSULATION

A. The backside of all supply air devices shall be insulated with taped and sealed external duct wrap matching the thickness, density, and R-value of the associated duct system.

B. The contractor shall install an additional layer of 1-½ inch thick external glass mineral wool duct wrap on any portion of the supply air, return air, outside air, or exhaust air system that has condensation forming during any period of operation. The insulation shall be taped and vapor-sealed and located until all evidence of the condensation has been eliminated, at no additional cost to the Owner.

3.7 KITCHEN GREASE HOOD EXHAUST DUCT

A. All type I kitchen range hood exhaust duct shall be enclosed with 2-hour fire rated enclosure.

B. The duct enclosure shall be sealed around the duct at the points of penetration with an approved fire barrier sealant per ASTM E1966. Sealant shall be 3M CP 25WB+ or 303 fire barrier caulk and putty.

C. The enclosure shall be separated from the duct by at least 3 inches and not more than 12 inches.

D. Cleanout openings at exhaust duct with access openings at the fire rated enclosure and access doors shall be provided at each duct offset and as required for proper operation and maintenance.

E. As an alternate method, the contractor may use two layers of 2-hour fire rated duct wrap such as 3M Fire Barrier Duct Wrap 615+ or Unifrax FyreWrap Elite 1.5 in lieu of the fire rated enclosure, provided that all the following constraints are satisfied:

1. Duct wrap system shall be tested per ASTM E2336 internal fire testing and have an achieved minimum fire resistance rating of 2 hours.
2. Product shall be approved by the local Authority Having Jurisdiction (AHJ).
3. Duct wrap system shall be mechanically attached to the duct using steel banding and/or weld pins per manufacturer's instructions.
4. Duct wrap system shall be installed in strict accordance with the manufacturer's instructions, including but not limited to zero clearance to combustibles at all locations on the wrap surface.

F. Insulation and all other requirements shall be provided per local codes.

3.8 DRYER VENT DUCT

A. All dryer vent duct routed within an air plenum shall be enclosed within a 1-hour fire rated enclosure.

B. The duct enclosure shall be sealed around the duct at the points of penetration with an approved fire barrier sealant per ASTM E1966. Sealant shall be 3M CP 25WB+ or 303 fire barrier caulk and putty.

C. The enclosure shall be separated from the duct by at least 3 inches and not more than 12 inches.

D. Cleanout openings at exhaust duct with access openings at the fire rated enclosure and access doors shall be provided at each duct offset and as required for proper operation and maintenance.

E. As an alternate method, the contractor may use a single layer of 1-hour fire rated duct wrap such as 3M Fire Barrier Duct Wrap 615+ or Unifrax FyreWrap Elite 1.5 in lieu of the fire rated enclosure, provided that all the following constraints are satisfied:

1. Duct wrap system shall be tested per ASTM E2336 internal fire testing and have an achieved minimum fire resistance rating of 1 hour.
2. Product shall be approved by the local Authority Having Jurisdiction (AHJ).
3. Duct wrap system shall be mechanically attached to the duct using steel banding and/or weld pins per manufacturer's instructions.
4. Duct wrap system shall be installed in strict accordance with the manufacturer's instructions, including but not limited to zero clearance to combustibles at all locations on the wrap surface.

F. Insulation and all other requirements shall be provided per local codes.

END OF SECTION

SECTION 23 07 16

HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Work specified elsewhere.

1. Basic materials and methods.
2. Piping systems.
3. Air distribution equipment.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ICC (IECC) - International Energy Conservation Code.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

I. SCAQMD 1168 - Adhesive and Sealant Applications.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.

C. All HVAC equipment insulation shall comply with minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P.

D. Adhesives and other materials shall comply with NFPA 90A and NFPA 90B. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer's stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 EQUIPMENT INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to ensure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed before any insulation is installed.

C. A sample quantity of each type of insulation and each type application shall be installed and reviewed prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. Glass mineral wool materials as manufactured by Knauf Insulation, Owens/Corning, Certain-Teed or Johns Manville will be acceptable, if they comply with the specifications.

E. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

F. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All insulation shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B. Furnish and install piping insulation to:

1. Condensate drain piping.
2. Refrigerant piping.
3. All pipes subject to freezing conditions shall be insulated.

C. Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D. For insulation purpose piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer well, unions, reducing stations, and orifice assemblies.

1.3 RELATED SECTIONS

A. Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

B. Section 23 05 53 - Identification for HVAC Piping and Equipment

C. Section 23 21 13 - Above Ground Hydronic Piping

D. Section 23 23 00 - Refrigerant Piping

1.4 REFERENCE STANDARDS

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.

C. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.

F. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

H. ICC (IECC) - International Energy Conservation Code.

I. SCAQMD 1168 - Adhesive and Sealant Applications.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.5 WARRANTY

A. Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.6 SUBMITTALS

A. SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B. PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.7 DELIVERY AND STORAGE

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.1 HVAC PIPING INSULATION

A. It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B. The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed prior to installation.

C. A sample quantity of each type of insulation and each type application shall be installed and accepted prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

E. All HVAC piping insulation thicknesses shall comply with minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P.

F. Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

G. All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

H. Any existing piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

2.2 APPROVED MANUFACTURERS

A. Calcium silicate materials shall be as manufactured by Johns Manville.

B. Glass mineral wool materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

C. Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armacell, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

D. Flexible elastomeric cellular thermal insulation by Armacell.

E. Phenolic foam insulation shall be as manufactured by Resolco, Inc. (Insul-Phen) or Polyguard (Poly-phen).

F. Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products.

2.3 MATERIALS

A. CONDENSATE DRAINAGE PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "Armaflex Ultra", fire rated for use in environmental air plenums; insulation not required when piping is exposed on roof.

B. REFRIGERANT PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "Armaflex Ultra", fire rated for use in environmental air plenums. Apply manufacturers recommended finish and sealant for exterior applications.

C. METAL JACKETING: Utilize Childers “Strap-On” jacketing. Provide preformed fitting covers for all elbows and tees.

D. ALL SERVICE JACKETING (ASJ+): Vapor retarder jacket for interior applications shall be composed of an aluminum foil layer, reinforced with glass scrim, bonded to a layer of white kraft paper, interleaving with an outer polymer film leaving no paper exposed; complying with ASTM C1136. Vapor retarder jacket for exterior applications shall be composed of a 3-ply composite membrane consisting of a white 0.5 mil polyester film, 1.0 mil aluminum foil, and one 0.5 mil clear polyester film; complying with ASTM C1136.

PART 3 - EXECUTION

3.1 GENERAL

A. All insulation shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

B. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

C. All heat recovery piping between air conditioning equipment and hydronic or domestic hot water piping shall be insulated per the High Temperature Surfaces Schedule below.

D. All condenser water piping located in a ceiling plenum shall be insulated per the requirements for indoor chilled water piping as indicated in the Low Temperature Surfaces Schedule below.

E. Pipes located outdoors or in tunnels shall be insulated same as concealed piping and shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All insulation butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

F. All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

G. Provide all HVAC piping insulation to comply with the ASHRAE Std 90.1 I-P Minimum Thickness Schedule and as indicated below.

1. Minimum Insulation Thickness for Low Temperature Surfaces
   a. Condensate drain lines: 1 inch
   b. Chilled Water Piping:
      1) Located outdoors: 2 inch
      2) Located indoors:
         a) 4 inch and smaller: 1-½ inch
         b) Larger than 4 inch: 2 inch
   c. Refrigerant Piping
      1) 1½“ and smaller: 1 inch
      2) Larger than 1½ inch: 1-½ inch
2. Minimum Insulation Thickness for High Temperature Surfaces
   a. Hot Water Piping:
      1) Operating temperature 105°F or less: 1 inch
      2) Operating temperature higher than 105°F and pipe size 1-¼ inch or smaller: 1-½ inch
      3) Operating temperature higher than 105°F and pipe size greater than 1-¼ inch: 2 inch
   b. Steam Piping:
      1) Pipe size 1-½ inch and smaller: 2-½ inch
      2) Pipe size more than 1-½ inch: 3 inch
   c. Refrigerant Piping
      1) 1-½ inch and smaller: 1-½ inch
      2) Larger than 1-½ inch: 2 inch

3.2 WATER PIPE INSULATION INSTALLATION

A. The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, a vapor dam shall be formed between the vapor retarder jacket and the bare pipe. The seal shall be by the applications of vapor retarder mastic to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B. Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass mineral wool covers finished with two brush coats of vapor retarder mastic reinforced with glass fabric.

C. All under lap surfaces shall be clean and free of dust, etc. before the joint is sealed. These laps shall be firmly rubbed to ensure a positive seal. A brush coat of vapor retarder mastic shall be applied to all edges of the vapor retarder jacket.

3.3 STANDBY-GENERATOR ENGINE EXHAUST PIPING

A. Entire engine exhaust pipe from exhaust manifold to outside terminal shall be enclosed in a 1" thick layer of calcium silicate insulation.

B. A second insulating layer of 1" thick calcium silicate shall cover the first layer.

C. Joints for the first and second layer shall be staggered.

D. Apply aluminum jacket over outer layer of insulation.

E. Insulate exhaust muffler in the same manner as the exhaust piping.

3.4 FIRE RATED INSULATION

A. All pipe penetrations through walls and concrete floors shall be fire rated by applying Owens Corning Thermafiber in the space between the concrete and the pipe.

B. The penetration shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C. All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.3 REFERENCES

A. AHRI 710 - Performance Rating of Liquid-Line Driers.

B. AHRI 730 (I-P) - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants.

D. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants.

E. ASHRAE Std 147 - Reducing the Release of Halogenated Refrigerants from Refrigerating and Air-Conditioning Equipment and Systems.

F. ASME A13.1 - Scheme for the Identification of Piping Systems.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

H. ASME B31.5 - Refrigeration Piping and Heat Transfer Components.

I. 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.

J. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

K. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

L. AWS B2.2/B2.2M - Specification for Brazing Procedure and Performance Qualification.

1.4 SUBMITTALS

A. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.

B. Piping: Submit data on pipe materials, fittings, and accessories.

C. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

D. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes.

E. Welding Certificates: Submit per AWS B2.2/B2.2M and ASME BPVC-IX.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide for the systems as shown. Submit shop drawings of piping systems showing all traps, pipe sizes, and accessories; drawing to be marked "Approved" and signed by a representative of the Application Engineering Department of the condensing unit manufacturer. Pipe sizes shall be as recommended by unit manufacturer. Refer to piping schematic on Drawings.

2.2 MATERIAL

A. PIPE: Type ACR copper tubing, hard-drawn, per ASTM B280.

B. FITTINGS: Wrought copper per ASME B16.22.

C. JOINTS: Brazed joints with Sil-Fos filler metal per AWS A5.8M/A5.8.

2.3 ACCESSORIES

A. All accessories shall be UL listed and rated in accordance with AHRI 710.

B. On systems 7-1/2 tons and larger, each separate refrigerant circuit shall have a separate filter drier rated in accordance with AHRI 730 (I-P). Each filter drier shall have a replaceable core and a three valve bypass. The filter drier shall be full line size and installed in the refrigerant liquid line. The filter shall have a minimum 4-3/4 inches diameter shell with removable flange and gasket. Flange shall be tapped for 1/4 inch FPT access valve. Size filter-drier for maximum 2.0 psi pressure drop at evaporator operating temperature. Similar to Mueller Refrigeration model Drymaster micro-guard refillable filter series SD-485 through SD19217 or Sporlan catch-all.

C. On systems less than 7-1/2 tons, the filter drier shall be the sealed type; sizes as above. One drier per refrigerant circuit.

D. Liquid-Moisture Indicator shall be full line size, installed in liquid refrigerant line. Indicator shall be rated for the applicable refrigerant, system pressure and temperature; manufactured by Mueller Refrigeration or Sporlan.

E. Thermostatic expansion valve shall have adjustable super heat and be as manufactured by Sporlan.

F. Shut-off valves shall be bi-directional ball valves with welded body, brass ball with dual Teflon seals and integral relief port. Valves shall be rated for the applicable refrigerant, system pressure and temperature. Valves shall be manufactured by Mueller Refrigeration or Sporlan.

2.4 REFRIGERANT AND OIL

A. Contractor shall leave the refrigeration system with a full charge of refrigerant and oil and shall be responsible for the maintenance of a full charge of refrigerant and oil in the systems for a period of one year from date of Substantial Completion.

B. Should any leaks in the refrigeration system occur during the guarantee period, the Contractor shall eliminate such leaks and recharge system to a full charge of refrigerant and oil at no cost to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment and piping shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer's requirements.

C. Refrigerant piping shall be installed in accordance with ASHRAE Std 15 and ASHRAE Std 34.

D. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required.

E. Braze joints per AWS B2.2/B2.2M and AWS A5.8M/A5.8 requirements.

F. Pipe shall be cut square, reamed and chamfered, and shall be free from burrs and obstruction. Pipe ends shall have full-bore openings and shall not be undercut.

G. Refrigerant piping located in areas other than the room or space where the refrigerating equipment is located shall be identified with pipe markers that meet labeling requirements of ASME A13.1. Markers shall be manufactured by W.H. Brady Company or approved equal. The pipe identification shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation. The minimum height of the identification lettering shall be 1/2". The pipe identification shall indicate the refrigerant designation and safety group classification of the refrigerant used in the piping system. For Group A2, A3, B2, and B3 refrigerants, the identification shall also include the following statement: "DANGER – Risk of Fire or Explosion. Flammable Refrigerant." For any Group B refrigerant, the identification shall also include the following statement: "DANGER – Toxic Refrigerant".

H. Refrigerant piping routed indoors shall be installed at a minimum of 7'-3" above finished floor when located above an area affording passage of occupants.

I. Refrigerant piping located indoors shall be located within building elements such as a ceiling or wall space or within a protective enclosure unless installed a minimum of 7'-3" above finished floor, within 6'-0" of the associated equipment or within a refrigerant machinery room.

J. Provide shield plates for refrigerant pipes containing Group A2L and B2L refrigerants that are located in concealed locations where piping is installed in studs, joists, rafters or similar member spaces, and are located less than 1-1/2 inches from the nearest edge of the member. Shield plates shall have a minimum thickness of 16 gage and shall extend two inches beyond the edge of the piping on each side.

K. Refrigerant pipe and joints installed in the field shall be exposed for visual inspection and testing prior to being covered or enclosed.

3.2 FIELD QUALITY CONTROL

A. Test piping and refrigeration system in accordance with ASME B31.5, ASHRAE Std 147, and this section.

B. The refrigerant piping system shall be tested as a whole or separate tests shall be conducted for the low-pressure side and high-pressure side of the piping system.

1. Pressure Test:
   a. Pressure test shall be performed using dry nitrogen.
   b. The means used to pressurize the refrigerant piping system shall have on its outlet side a test pressure measuring device and either a pressure-limiting device or a pressure-reducing device. The test pressure measuring device shall have an accuracy of +/- 3% or less of the test pressure and shall have a resolution of 5% or less of the test pressure.
   c. The system shall be pressurized for a period of not less than 60 minutes. Additional test gas shall not be added to the system after the start of the test.
   d. Test pressure shall be at least 110% of the system design pressure.
   e. Test pressure shall not exceed 130% of the design pressure of any component in the system.
   f. The system shall not show loss of pressure on the on the test measuring device throughout the entirety of the test.
2. Evacuation and Leak Test:
   a. Evacuate moisture completely by applying a commercial vacuum pump. Moisture indicator shall indicate a completely moisture-free condition at time of final inspection.
   b. The vacuum pump shall run until the system indicates a vacuum of 500 microns.
   c. After achieving a vacuum, the system shall be isolated from the vacuum pump. The system pressure shall not rise for a minimum of 24 hours.
   d. The system shall be flushed with the operating refrigerant and the vacuum pump connected and rerun to repeat the evacuation. Evaluation shall be performed under supervision of the Engineer.

C. Repair any and all leaks and retest as required.

END OF SECTION

SECTION 23 31 13

METAL DUCTWORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Low pressure ductwork.

B. Medium and high pressure ductwork.

C. Casings.

D. Commercial dryer vent.

E. Duct leakage testing.

F. Duct system protection.

G. Duct system cleaning.

1.2 RELATED SECTIONS

A. Division 9 - Finishes: Weld priming, weather resistant, paint or coating.

B. Section 23 02 00 - Basic Materials and Methods for HVAC

C. Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

D. Section 23 05 93 - Testing, Adjusting, And Balancing

E. Section 23 07 13 - Duct Insulation

F. Section 23 33 00 - Ductwork Accessories

G. Section 23 37 13 - Air Distribution Devices

1.3 REFERENCES

A. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

D. NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System.

E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

H. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

I. ASHRAE (FUND) ASHRAE Handbook - Fundamentals; Chapter 21 - Duct Design.

J. ASHRAE (HVACS) ASHRAE Handbook - HVAC Systems and Equipment; Chapter 19 - Duct Construction.

K. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

N. ICC (IECC) - International Energy Conservation Code.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firms with least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

1.5 GENERAL DESCRIPTION

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

1.6 SUBMITTALS

A. Submit shop drawings, duct fabrication standards and product data under provisions of Division One.

B. Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work.

C. The contract documents are schematic in nature and are to be used only for design intent. The contractor shall prepare sheet metal shop drawings, fully detailed and drawn to scale, indicating all structural conditions, all plumbing pipe and light fixture coordination, and all offsets and transitions as required to permit the duct to fit in the space allocated and built. All duct revisions required as a result of the contractor not preparing fully detailed shop drawings will be performed at no additional cost.

1.7 DEFINITIONS

A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain indicated clear size inside lining. Where offsets or transitions are required, the duct shall be the equivalent size based on constant friction rate.

B. Low Pressure: Low pressure ductwork shall be rated for an operating pressure of 2". Low pressure ductwork shall be defined as all return, exhaust, and outside air ducts, all supply ductwork associated with constant volume air handling units with a scheduled external static pressure of less than 2", and all supply ductwork downstream of terminal units in variable volume systems.

C. Medium Pressure: Medium pressure ductwork shall be rated for an operating pressure of 4". Medium pressure ductwork shall be defined as all supply ductwork extending from variable volume air handling units to terminal units in variable volume systems with air handling units having a scheduled external static pressure of less than 4". The supply ductwork of constant volume air handling units having a scheduled external static pressure greater than 2" and less than 4" shall be rated for medium pressure.

D. High Pressure: High pressure ductwork shall be rated for an operating pressure of 6", or the scheduled external pressure of the equipment it is connected to, whichever is greater. The supply ductwork of air handling units having a scheduled external static pressure greater than 4" shall be high pressure.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings, use sheet metal end caps on any lined duct exposed to the weather.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A653/A653M.

C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A480/A480M; Type 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

D. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B209, Alloy 3003, Temper H14.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Non-combustible and conforming to UL 181, Class 1 air duct materials.

B. Flexible Ducts: Flexmaster U.S.A., Inc. Type 5M, Thermaflex MKE, ATCO #036 or approved equal.

1. Flexible ducts shall be corrosive resistant galvanized steel formed and mechanically locked to inner fabric with minimum 1-1/2" thick, R-8 insulation. Flexible duct shall be rated up to at least 10 in.w.g. positive pressure and shall have reinforced metalized outer jacket to comply with UL 181, Class 1 air duct.

C. Sealants: Hard-Cast “iron grip” or approved equal, non-hardening, water resistant, fire resistive and shall not be a solvent curing product. Sealants shall be compatible with mating materials, liquid used alone or with tape or heavy mastic.

D. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

1. For exposed stainless steel ductwork, provide matching stainless steel support materials.
2. For aluminum ductwork, provide aluminum support materials.

2.3 LOW PRESSURE DUCTWORK

A. Fabricate and support in accordance with latest SMACNA (DCS) Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings. Obtain engineer’s approval prior to using round duct in lieu of rectangular duct.

C. Construct T's, 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 are used, provide airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

E. Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of airflow.

F. Use double nuts and lock washers on threaded rod supports.

2.4 MEDIUM AND HIGH PRESSURE DUCTS

A. Fabricate and support in accordance with SMACNA (DCS) Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B. Construct T's, bends, and elbows with radius of not less than 1½ times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal with glass fiber insulation. Weld in place.

C. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

D. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

E. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.5 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) Standards and SMACNA High Pressure Duct Construction Standards and construct for operating pressures indicated.

B. Mount floor mounted 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 18 gauge galvanized expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.

C. Reinforce doorframes with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection. Provide clear wire glass observation ports, minimum 6 X 6 inch size.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gauge back facing and 22 gauge perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb./cubic foot minimum glass fiber media, on inverted channels of 16 gauge.

2.6 EXPOSED DUCTWORK LOCATED INDOORS

A. Where ductwork is indicated to be exposed to view in occupied spaces, provide round or flat oval, double wall galvanized steel construction with spiral lockseam, United McGill Corporation model Acousti-k27 or approved equal.

2.7 KITCHEN HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA (DCS) Standards, and NFPA 96.

B. Construct of 16 gauge carbon steel or 18 gauge stainless steel, using continuous external welded joints.

C. Slope all duct toward the kitchen hood or a grease reservoir so that grease cannot collect in any portion of duct per mechanical code.

2.8 DOMESTIC RANGE HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA (DCS) Standards.

B. Construct of minimum 26 gauge galvanized steel.

2.9 DISHWASHER/SHOWER/LOCKER ROOM EXHAUST DUCTWORK

A. All ductwork shall be stainless steel, one gauge heavier than that required for galvanized steel duct.

B. Slope all duct to drain out grilles or provide drain line to floor drain.

2.10 COMMERCIAL DRYER VENT

A. Construct of 18 gauge, Type 316 stainless steel.

B. All welded construction.

C. Provide hard duct connection to dryer.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain manufacturer's inspection and acceptance of fabrication and installation of ductwork at beginning of installation.

B. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

C. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D. Connect terminal units to medium or high pressure ducts with four feet maximum length of flexible duct. Do not use flexible duct to change direction.

E. Connect diffusers or troffer boots to low pressure ducts with 6 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with strap or clamp.

F. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

G. The interior surface of all ductwork shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

H. All ductwork located exposed on roof shall be "crowned" to prevent water from ponding. Ref: Insulation for additional requirements.

I. Where ducts pass through non-rated floors, provide structural angles for duct support. Where ducts pass through non-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches. Where ducts pass through rated interior partitions, rated exterior walls, or rated floors, install fire dampers or smoke dampers as required. Provide sleeves for dampers not provided with factory sleeve. Refer to Section 23 33 00 - Duct Accessories for fire and smoke damper requirements.

J. All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.

K. All ductwork shall be fabricated in a manner to prevent the seams or joints being cut for the installation of grilles, registers, or ceiling outlets.

L. All duct hangers shall be attached to building structure. Cutting slots in roof or floor decking for hanger straps to be cast in concrete is not acceptable.

3.2 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 5'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA (DCS).

3.3 REQUIREMENTS FOR DUCTS BURIED UNDERGROUND

A. Slope underground ducts to plenums or low pump-out points at l:500. Provide access doors for inspection.

B. Coat buried, metal ductwork without factory jacket with one coat and seams and joints with additional coat of asphalt base protective coating.

C. Insulate buried supply duct runs over 50 feet long with one inch thick insulation covered with plastic vapor barrier.

D. Encase buried metal ductwork in 3 inch minimum of concrete. Provide adequate tie-down points to prevent ducts from floating during concrete placement. Introduce no heat into ducts for 20 days following placement of concrete.

3.4 REQUIREMENTS FOR UNIT CASINGS

A. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

3.5 REQUIREMENTS FOR KITCHEN HOOD EXHAUST DUCTWORK

A. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.

B. Provide access openings in each change in direction, located on sides of duct 1½" minimum from bottom, and fitted with grease-tight covers of same material as duct

C. Use stainless steel for ductwork exposed to view.

3.6 DUCTWORK APPLICATION SCHEDULE

A. Ductwork materials shall be provided to comply with the following:

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel, Aluminum
Buried Supply or Return	Concrete, Glass Fiber Reinforced Plastic
Medium and High Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Kitchen Hood Exhaust	Carbon Steel, Stainless Steel
Dishwasher/Shower/Locker Room/Dryer Vent/Paint Hood Exhaust	Stainless Steel
Fume Hood Exhaust	Carbon Steel, Stainless Steel, Glass Fiber Reinforced Plastic if not in air plenum
Welding Exhaust	Carbon Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel
Emergency Generator Ventilation	Carbon Steel

3.7 DUCTWORK HANGERS AND SUPPORTS

A. All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the ductwork, provide a minimum of two screws one at the bottom and one in the side of each strap on metal ductwork. The spacing, size and installation of hangers shall be in accordance with the recommendations of the latest SMACNA edition.

B. All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Structural steel supports for duct risers shall be provided under this Division.

3.8 AIR DUCT LEAKAGE: (FROM SMACNA DUCT STANDARDS LATEST EDITION) TEST ALL DUCTWORK (DESIGNED TO HANDLE OVER 1,000 CFM) AS FOLLOWS:

A. Test apparatus

1. A source of high pressure air-a portable rotary blower or a tank type vacuum cleaner.
2. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

B. Test Procedures

1. Test for audible leaks as follows:
2. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.

a. Start the blower with its control damper closed.
b. Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.
c. Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.

3. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:
   a. Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.
   b. Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.
   c. Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
   d. Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which, must be corrected.
4. Testing Report
   a. Contractor shall provide a testing report for each air system to the engineer. The report shall indicate the completion of testing and compliance with testing specification.
   b. All duct testing reports shall be included in the final close out documents.

3.9 DUCT SYSTEM PROTECTION

A. Provide temporary closures at the ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation; provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

B. Provide temporary construction filters on air handling equipment and/or return air ductwork during construction to protect ductwork and equipment from dust.

C. Any ductwork stored on site with observable dirt or debris inside shall be cleaned by a third party.

D. If the air handling system has been operated without temporary construction filters or if the integrity of the temporary closures has been compromised, the contractor shall have the duct system cleaned per the following section.

3.10 DUCT SYSTEM CLEANING

A. For renovation projects and HVAC retrofit applications wherein existing duct systems are scheduled to be re-used, or where required by the Duct System Protection section above, the contractor shall have the existing duct systems cleaned in accordance with the current published standards of ASHRAE, NADCA ACR and as indicated below.

B. Duct system cleaning method used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

C. All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

D. All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

E. Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

F. Duct cleaning method used shall not damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

G. Replace the fiberglass material if there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating.

H. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

I. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

J. Cleaning Report: Contractor shall provide a report to the Owner indicating the completion of duct cleaning per specification and areas of the duct system found to be damaged and/or in need of repair.

3.11 DUCT JOINTS AND SEAMS

A. All ductwork shall be constructed to Seal Class A, as referenced in SMACNA (DCS).

B. All non-welded joints and seams shall be sealed. This includes but is not limited to:

1. Transverse joints.
2. Longitudinal seams.
3. Duct wall penetrations.
4. Spin-ins, taps, and other branch connections.
5. Access doors, access panels, and duct connections to equipment.

C. Openings for rotating shafts shall be sealed with bushings.

END OF SECTION

SECTION 23 33 00

DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Volume control dampers.

B. Shutoff Dampers.

C. Round Duct Taps.

D. Conical Duct Taps.

E. Fire dampers.

F. Combination fire and smoke dampers.

G. Back draft dampers.

H. Air turning devices.

I. Flexible duct connections.

J. Duct access doors.

K. Duct test holes.

1.2 RELATED WORK

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

C. Section 23 31 13 - Metal Ductwork

1.3 REFERENCES

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ICC (IECC) - International Energy Conservation Code.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible.

F. UL 33 - Safety Heat Responsive Links for Fire-Protection Service.

G. UL 555 - Standard for Fire Dampers.

H. UL 555S - Standard for Smoke Dampers.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Provide shop drawings for shop fabricated assemblies indicated, including volume control dampers duct access doors duct test holes. Provide product data for hardware used.

C. Submit manufacturer's installation instructions under provisions of Division 1, for fire dampers and combination fire and smoke dampers.

PART 2 - PRODUCTS

2.1 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS), and as indicated.

B. Fabricate splitter dampers of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.

C. Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/2 inch diameter rod in self aligning, universal joint, action flanged bushing, with set screw.

D. Fabricate single blade dampers for duct sizes to 9-1/2 x 24 inch.

E. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch.

1. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
2. On outside air, return air, and all other dampers required to be low leakage type, provide galvanized blades and frames, seven inches wide maximum, with replaceable vinyl, EPDM, silicone rubber seals on blade edges and stainless steel side seals. Provide blades in a double sheet corrugated type construction for extra strength. Provide hat channel shape frames for strength and blade linkage enclosure to keep linkage out of the air stream. Construction leakage not to exceed 1/2%, based on 2,000 fpm and 4 inch static pressure.

F. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.

H. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.2 SHUTOFF DAMPERS

A. Fabricate in accordance with SMACNA (DCS), and as indicated.

B. Provide Class I multi-blade damper of parallel blade pattern for all ductwork systems which penetrate the building thermal envelope in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P.

1. Damper shall be constructed of one-piece 16 ga. roll-formed galvanized steel hat-shaped channel frame. Blades shall be 14 ga. roll-formed galvanized steel, airfoil type. Blade edge seals shall be neoprene gaskets mechanically locked to blade edge. Bearings shall be 304 stainless steel, oil-impregnated and self-lubricating sleeve type, turning in extruded holes in damper frame.

C. Shutoff dampers shall have an air leakage rate not greater than 4 cfm/ft^2 of damper surface area at 1.0 in.w.g. and shall be labeled by an approved agency when tested in accordance with AMCA 500-D for such purpose.

2.3 ROUND DUCT TAPS

A. Taps to trunk duct for round flexible duct shall be spin-in fitting with locking quadrant butterfly damper, model no. FLD-B03 by Flexmaster or approved equal.

2.4 CONICAL DUCT TAPS

A. Taps to trunk duct for primary air inlet to all VAV terminal units shall be conical fitting, model no. CB by Flexmaster or approved equal.

2.5 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS

A. Greenheck.

B. Louvers and Dampers Inc.

C. Ruskin.

D. Nailor Industries.

E. Pottorff.

2.6 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Provide curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream. Provide factory sleeve for each damper.

C. Fabricate multiple blade fire dampers per UL with 16 gauge minimum galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

D. Fusible links, UL 33, shall separate at 165 degrees F. Provide adjustable link straps for combination fire/balancing dampers.

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S and as indicated.

B. Provide factory sleeve for each damper. Install damper operator on exterior of sleeve and link to damper operating shaft.

C. Fabricate with multiple blades with 16 gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

1. Operators shall be spring return electric type suitable to operate on 120 VAC, 60 cycle.
2. Operators shall be UL listed and labeled.

2.8 SMOKE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, UL 555S and as indicated.

B. Motorized Smoke Dampers: multi-blade type, normally open with power on, close automatically when power is interrupted, UL-listed and labeled damper and damper operator.

2.9 ACCEPTABLE MANUFACTURERS - BACKDRAFT DAMPERS

A. Greenheck.

B. American Warming and Vent.

C. Louvers and Dampers Inc.

D. Ruskin.

E. Pottorff.

F. Substitutions: Under provisions of Division One.

2.10 BACKDRAFT DAMPERS

A. Gravity back draft dampers, size 18 x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturers standard construction.

B. Fabricate multi-blade, parallel action gravity balanced back draft dampers of 16 gauge galvanized steel, or extruded aluminum, with 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.

C. Gravity backdraft dampers shall have an air leakage not greater than 20 cfm/ft^2 where not less than 24 inches in either dimension and 40 cfm/ft^2 where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 in.w.g. when tested in accordance with AMCA 500-D for such purpose.

2.11 ACCEPTABLE MANUFACTURERS - AIR TURNING DEVICES

A. Young Regulator.

B. Titus.

C. Tuttle and Bailey.

D. Substitutions: Under provisions of Division One.

2.12 AIR TURNING DEVICES

A. On duct sizes less than 12 x 12, multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with worm drive mechanism with 18 inch long removable key operator.

2.13 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT CONNECTIONS

A. Metaledge.

B. Ventglass.

C. Substitutions: Under provisions of Division One.

2.14 FLEXIBLE DUCT CONNECTIONS TO AIR MOVING EQUIPMENT

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz. per sq. yd., approximately 6 inches wide, crimped into metal edging strip.

2.15 ACCEPTABLE MANUFACTURERS - DUCT ACCESS DOORS

A. Greenheck.

B. American Warming and Vent.

C. Ruskin.

D. Titus.

E. Substitutions: Under provisions of Division One.

2.16 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Review locations prior to fabrication.

C. Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover. Insulation shall be replaceable without field cutting or patching.

D. Access doors smaller than 12 inches square may be secured with sash locks.

E. Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.

F. Access doors with sheet metal screw fasteners are not acceptable.

2.17 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions.

B. Balancing Dampers

1. Provide at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing. Use splitter dampers only where indicated.
2. All regulators mounted on externally insulated ductwork shall have 16 gauge elevated platforms at least 1/8 inch higher than the thickness of the insulation. Damper shaft shall have Ventlock No. 607 bearing mounted on ductwork within elevated platform. If duct is inaccessible the operating handle shall be extended and the regulator installed on the face of the wall or ceiling. Where regulators are exposed in finished parts of the building, they shall be flush type, Ventlock No. 666. All regulators shall be manufactured by Ventlock, or approved equal.
3. All dampers in lined ductwork shall have bushing to prevent damper damage to liner.

C. Provide fire 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.

D. Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.

E. Provide gravity backdraft dampers or motorized shutoff dampers in accessible location nearest to exterior wall/roof penetrations and where indicated for all outdoor air intake and exhaust systems to automatically shut when the associated systems or spaces served are not in use.

F. Provide flexible duct connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Provide at least one inch slack at all flexible duct connections.

G. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.

H. Provide duct access doors for inspection and maintenance of all fire dampers, smoke dampers, and combination fire/smoke dampers. Provide minimum 12 x 12 inch size access opening where duct size permits. All duct sizes that cannot accommodate a minimum 12 x 12 inch access opening shall be provided with a removable duct section to permit inspection and maintenance of the damper and its operating parts. Removable duct sections shall match the pressure class of the associated duct system, maintain 100 percent of the duct free area, and utilize gaskets and clamp type draw latches to allow removal and reinstallation without the use of tools.

I. Provide duct test holes where indicated and required for testing and balancing purposes.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Ceiling and inline ventilators

B. Utility fans

1.3 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

D. Section 23 05 93 - Testing, Adjusting, And Balancing

E. Section 23 09 63 - Energy Management and Control System (EMCS)

F. Section 23 33 00 - Ductwork Accessories

1.4 REFERENCES

A. AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

C. AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance.

D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

F. AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance.

G. ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

H. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

J. FLA (FBC-B) - Florida Building Code: Building (7th Edition).

K. ICC (IBC) - International Building Code.

L. ICC (IECC) - International Energy Conservation Code.

M. Miami (APD) - Approved Products Directory; Miami-Dade County.

N. NFPA 70 - National Electrical Code.

O. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

P. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

Q. UL 705 - Power Ventilators.

R. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances.

1.5 QUALITY ASSURANCE

A. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705.

B. UL Compliance: Fans and components shall be UL listed and labeled.

C. Nationally Recognized Testing Laboratory Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

D. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E. Electrical Component Standard: Components and installation shall comply with NFPA 70.

F. Sound Power Level Ratings: Comply with AMCA 301. Test fans in accordance with AMCA 300. Fans shall be licensed to bear the AMCA 300 Seal.

G. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA 210.

H. Motors for fans that are not less than 1/12 hp (0.082 kW) and less than 1 hp (0.746 kW) shall be electronically commutated motors per ICC (IECC) and ASHRAE Std 90.1 I-P.

I. High Wind models shall be analyzed and stamped by a state license P.E. to the ASCE 7-16 Standard which meets the ICC (IBC), FLA (FBC-B), and Miami (APD) codes.

J. Each High Wind model is subject to be certified by a Nationally Recognized Testing Laboratory to ASTM E330/E330M.

1.6 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B. Product data for selected models, including specialties, accessories, and the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound power ratings.
3. Motor ratings and electrical characteristics plus motor and fan accessories.
4. Materials, gages and finishes, include color charts.
5. Dampers, including housings, linkages, and operators.
6. Full color paint samples.

C. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D. Coordination drawings, in accordance with Division 23, Section "Basic Materials and Methods", for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension members.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

E. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

F. Product certificates, signed by manufacturer, certifying that their products comply with specified requirements.

G. Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Materials and Methods".

H. Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Fans shall be stored and handled in accordance with the unit manufacturer’s instructions.

B. Lift and support units with the manufacturer`s designated lifting or supporting points.

C. Disassemble and reassemble units as required for movement into the final location following manufacturer`s written instructions.

D. Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Greenheck Fan Corporation

B. Loren Cook Company

C. Pennbarry

D. ACME

E. Twin City Fan and Blower

2.2 GENERAL DESCRIPTION

A. Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.

B. Fans and Shafts shall be statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

C. Provide factory baked-enamel finish coat after assembly. Color for roof mounted fans shall be chosen by Architect during the submittal process.

2.3 CEILING AND INLINE VENTILATORS

A. Ceiling and inline ventilators shall be direct drive or belt drive as indicated, centrifugal blower type. Fan wheel shall be constructed of galvanized steel and shall be dynamically balanced. The housing shall be constructed of minimum 20 gauge corrosion resistant galvanized steel and acoustically insulated for quiet operation. Blower and motor assembly shall be easily removable from the housing without disturbing the ductwork. The motor shall be permanently lubricated with built-in thermal overload protection and shall be factory tested prior to shipment. The ceiling ventilators shall be furnished standard with a powder-painted white steel grille.

B. Ventilators shall be certified and licensed to bear the AMCA Seal for Air and Sound Performance. Ventilator performance shall be based on tests and procedures performed in accordance with AMCA 211 and comply with the requirements of the AMCA Certified Ratings Program. Fan sound power level ratings shall be based on tests and procedures performed in accordance with AMCA 311 and comply with the requirements of the AMCA Certified Ratings Program. Ventilators shall be UL listed and CSA certified.

C. Accessories: The following accessories are required.

1. Dampers:
   a. Aluminum backdraft damper.
   b. Motor-operated volume control damper.
   c. L listed ceiling radiation damper for ceiling fans comply with NFPA 90A rated for 3 hours
2. Disconnect Switch: Nonfusible type with thermal overload protection.
3. Speed Controls: Fan mounted, solid state speed controller.

2.4 UTILITY FANS

A. Fans shall be of the direct driven or belt driven utility fan type as indicated with a single width, single inlet housing in AMCA arrangement 10.

B. The housing shall be constructed of minimum 14 gauge steel with continuously welded or lock formed seams permitting no air leakage. The housing shall be field rotatable to any of the eight standard discharge positions. Housing and bearing supports shall be constructed of minimum 10 gauge welded steel members to prevent vibration and rigidly support the shaft and bearings. Side access inspection port shall be provided for access to the motor compartments.

C. The fan wheel shall be of the forward curved type C, non-overloading backward inclined, centrifugal fan type and constructed of heavy gauge steel.

D. Wheels shall be statically and dynamically balanced. The wheel cone and fan inlet cone shall be carefully matched for maximum performance and operating efficiency.

E. Motors shall be permanently lubricated, heavy duty, ball bearing type carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. The fan shaft shall be ground and polished solid steel mounted in heavy duty, permanently sealed, pillow block ball bearings. Bearings shall be selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulley shall be adjustable for final system balancing.

F. Fan performance shall be based on tests conducted in accordance with AMCA 210. Fans shall be licensed to bear the AMCA Certified Ratings Seal for air performance.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

D. Refer to 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment for additional installation requirements.

E. Flexible duct connections and shutoff dampers are prohibited from being installed in duct systems conveying grease laden exhaust air per NFPA 96 requirements.

END OF SECTION

SECTION 23 34 39

HIGH-VOLUME, LOW-SPEED PROPELLER FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. Powerfoil X4.0
2. Basic 6
3. Essence

B. Summary of Work

1. Provide the ceiling-mounted, circulation fans with the models scheduled and with the capacities indicated. The fan shall be furnished with standard mounting hardware and variable speed control to provide cooling and destratification.
2. Installation of the fan, miscellaneous or structural metal work (if required), field electrical wiring, cable, conduit, fuses and disconnect switches, other than those addressed in the installation scope of work, shall be provided by others.

1.2 RELATED SECTIONS

A. Section 21 00 00 - Fire Protection

B. Section 23 02 00 - Basic Materials and Methods for HVAC

C. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

D. Section 23 05 53 - Identification for HVAC Piping and Equipment

E. Section 26 02 00 - Basic Materials and Methods for Electrical

F. Section 28 46 00 - Fire Alarm and Smoke Detection System

1.3 REFERENCES

A. 10 CFR 430, Appendix U to Subpart B - Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

C. CSA C22.2 No. 113 - Fans and Ventilators.

D. ISO 9001 - Quality management systems -- Requirements.

E. NFPA 13 - Standard for the Installation of Sprinkler Systems.

F. NFPA 70 - National Electrical Code.

G. NFPA 72 - National Fire Alarm and Signaling Code.

H. UL 507 - Electric Fans.

I. AMCA 230 - Laboratory Methods Of Testing Air Circulating Fans For Rating And Certification.

J. ROHS - Restriction of Hazardous Substances

K. NEMA - National Electrical Manufacturers Association

1.4 QUALITY ASSURANCE

A. Certifications

1. The fan assembly, as a system, shall be Intertek/ETL-certified and built pursuant to the guidelines set forth by UL 507 and CSA standard 22.2 No. 113.
2. The fan shall be compliant with NFPA 13, NFPA 72 and NFPA 70.
3. Controllers shall comply with National Electrical Code (NEC) and Underwriters Laboratory (UL) standards and shall be labeled where required by code.
4. Fans shall be tested to meet the minimum efficiency requirements of 10 CFR 430, Appendix U to Subpart B.

B. Manufacturer Qualifications

1. The fan and any accessories shall be supplied by a company that has a minimum of ten (10) years of product experience.
2. ISO 9001 - certified

1.5 SUBMITTALS

A. Shop Drawings: Drawings detailing product dimensions, weight, and attachment methods.

B. Product Data: Specification sheets on the ceiling-mounted fan, specifying electrical and installation requirements, features and benefits, and controller information.

C. Revit Files: File provided for Contractor’s coordination drawings.

D. Installation Guide: The manufacturer shall furnish a copy of all operating and maintenance instructions for the fan. All data is subject to change without notice.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver product in original, undamaged packaging with identification labels intact. The fan shall be new, free from defects, and factory tested.

B. The fan and its components must be stored in a safe, dry location until installation.

1.7 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

1.8 WARRANTY

A. The manufacturer shall replace any products or components defective in material or workmanship for the customer free of charge including transportation charges in accordance to the following schedule:

1. HVLS fans scheduled as Powerfoil X4.0 Fans:
   a. Mechanical - 15 years
   b. Electrical - 7 years
   c. Labor - 1 year
2. HVLS fans scheduled as Basic 6 Fans:
   a. Mechanical - 7 years
   b. Electrical - 3 years
   c. Labor - 1 year
3. HVLS fans scheduled as Essence Fans:
   a. Mechanical - 10 years
   b. Electrical - 5 years
   c. Labor - 1 year

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Big Ass Fans

B. Entrematic

C. Macroair

2.2 HIGH VOLUME, LOW SPEED FANS - BIG ASS FANS POWERFOIL X4.0

A. Complete Unit

1. Regulatory Requirements:
   a. The entire fan assembly (with or without light kit) shall be Intertek/ETL-certified and built pursuant to the construction guidelines set forth by UL 507 and CSA C22.2 No. 113.

b. The BAFCon controller shall be compliant with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) The device may not cause harmful interference, and (2) The device must accept any interference received, including interference that may cause undesirable operation.

2. Sustainability Characteristics:
   a. The fan shall be designed to move an effective amount of air for cooling and destratification in a variety of applications (including industrial and agricultural) over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. Sound levels from the fan operating at maximum speed measured in a laboratory setting shall not exceed 55 dBA. Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.
   b. The BAFCon controller shall be designed to control Big Ass Fans and lighting systems from a secure, centralized location. The system shall be designed specifically for high volume, low speed Big Ass Fans to ensure maximum control. The system shall include optional SmartSense functionality to maximize energy savings. SmartSense shall provide the capability to automatically control the speed of Big Ass Fans using information from user-determined settings and built-in temperature and humidity sensors.
3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.

B. Onboard Fan Control

1. The onboard fan controller shall be constructed using a variable frequency drive (VFD) that is pre-wired to the motor and factory-programmed to minimize the starting and braking torques for smooth and efficient operation. The onboard controller shall be prewired to the motor using a short run of flexible conduit with a dedicated ground conductor to minimize electromagnetic interference (EMI) and radio frequency interference (RFI). A 15-ft incoming power cord shall be pre-wired to the controller with one of the following plugs: NEMA L6-20P Twist-Lock Plug, NEMA L6-30P Twist-Lock Plug, NEMA L15-20P Twist Lock Plug, NEMA L16-20P Twist-Lock Plug.
2. As an option, the architect or owner may upgrade to the “harsh environment package,” which includes a seal for the weather-resistant onboard VFD enclosure and a motor with IP55 NEMA classification.
3. For fans with single-phase input, conversion to three-phase output takes place at the VFD.

C. Airfoil System

1. The fan shall be equipped with eight (8) Powerfoil airfoils of precision extruded aluminum alloy. The airfoils shall be connected by means of two (2) high strength locking bolts per airfoil. The airfoils shall be connected to the hub and interlocked with zinc plated steel retainers.

2. The fan shall be equipped with eight (8) Powerfoil winglets (standard) or eight (8) Powerfoil Plus winglets (optional) on the ends of the airfoils and eight (8) AirFences® positioned on the airfoils at the optimum location for performance. Both the winglets and AirFences shall be molded of a polypropylene blend. The standard color of the winglet and AirFence shall be "Safety Yellow." Color shall be as scheduled and shall be coordinated with the architect and owner prior to ordering.
3. Airfoil Restraint System
    a. All 20- to 24-ft diameter fans shall be equipped with a patented airfoil restraint system to provide redundant safety between the ends of the airfoils and the fan hub. The airfoil restraint system shall be available as an option on smaller diameter fans.
    b. The airfoil restraint system shall be comprised of durable, lightweight nylon safety straps that shall extend from winglets through the airfoils and secure to the fan hub with 12-gauge stamped steel safety clips.
    c. The straps shall be made of 1 in. wide heavy-duty nylon webbing rated for 825 lb. The loops at the ends of the straps shall be secured in a double-stitch pattern for reinforced durability.
    d. The straps shall be precisely matched to each fan's diameter, eliminating the need for a tensioning mechanism and reducing opportunity for noise.
    e. The straps shall run along the inside of the airfoils for an uninterrupted look.
    f. Safety clips are preattached to each winglet at the factory to comprise the outer anchor points and provide tension, while clips on the opposite end secure to threaded inserts incorporated in the fan hub.

D. Motor

1. The fan motor shall be an AC induction type inverter rated at 1725 RPM, 200-240/400-480 VAC, 50/60 Hz, three-phase.
2. The motor shall be totally enclosed, fan cooled (TEFC) with an IP44 NEMA classification. A NEMA 56C standard frame shall be provided for ease of service. The motor shall be manufactured with a double baked Class F insulation and be capable of continuous operation in 32°F to 122°F ambient conditions.
3. The motor shall have a C-face attachment that shall enable technicians to detach the motor for easy field service. The C-face motor adapter shall be designed to work with the NitroSeal™ gearbox.
4. As an option, the architect or owner may upgrade to the "harsh environment package," which includes a motor with an IP55 NEMA classification. As part of the "harsh environment package," the onboard VFD enclosure is sealed for weather-resistant operation.

E. Gearbox

1. The fan gearbox shall be a NitroSeal™ Drive designed specifically for the Powerfoil X series. The gearbox shall include a high-efficiency, hermetically sealed, nitrogen-filled, offset helical gear reducer with two-stage gearing, a hollow output shaft, cast iron housing, double lip seals, high quality SKF Explorer Series bearings with crowned cages for optimal lubrication flow, and precision machined gearing to maintain backlash less than 11 arc-minutes over the life of the unit. Lubrication shall be high-grade, low-foaming synthetic oil with extreme pressure additives and a wide temperature range, and shall be lubricated for the life of the product (no oil changes required).
2. The gearbox shall be equipped with a hollow shaft threaded to accept a ¾" NPT fitting in which wiring, piping, etc., can be routed to below the fan. A standard junction box can be affixed to this hollow shaft to allow for installing optional features such as lights or cameras. The inclusion of the hollow shaft shall be specified at the time of order.

F. Mounting Post

1. The fan shall be equipped with a mounting post that provides a structural connection between the fan assembly and extension tube. The mounting post shall be formed from A36 steel, contain no critical welds, and be powder coated for corrosion resistance and appearance.

G. Mounting System

1. The fan mounting system shall be designed for quick and secure installation on a variety of structural supports. The design of the upper mount shall provide two axes of rotation. This design shall allow for adjustments to be made after the mount is installed to the mounting structure to ensure the fan will hang level from the structure.
2. The upper mount shall be of ASTM A-36 steel, welded construction, at least 3/16" thick, and powder coated for appearance and corrosion resistance. No mounting hardware or parts substitutions, including cast aluminum, are acceptable.
3. All mounting bolts shall be SAE Grade 8 or equivalent.

H. Hub

1. The fan hub shall be 19" in diameter and shall be made of precision cut aluminum for high strength and light weight. The hub shall consist of two (2) aluminum plates, eight (8) aluminum spars, and one (1) aluminum spacer fastened with a pin and collar rivet system. The overall design shall provide a flexible assembly such that force loads experienced by the hub assembly shall be distributed over a large area to reduce the fatigue experienced at the attachment point for the fan blade.
2. The hub shall be secured to the output shaft of the gearbox by means of (10) high strength bolts. The hub shall incorporate five (5) safety retaining clips made of 1/4" thick steel that shall restrain the hub/airfoil assembly.

I. Safety Cables

1. The fan shall be equipped with an upper safety cable that provides an additional means of securing the fan assembly to the building structure. The upper safety cable shall have a diameter of 3/8".
2. The fan shall be equipped with two lower safety cables pre-attached to the fan hub that shall provide an additional means of securing the fan to the extension tube. The lower safety cables shall have a diameter of 1/4".
3. The safety cables shall be fabricated out of 7 x 19 galvanized steel cable. The end loops shall be secured with swaged Nicopress® sleeves, pre-loaded and tested to 3,200 lbf.
4. Field construction of safety cables is not permitted.

J. Digital Variable Speed Wall Controller

1. The fan shall be equipped with a digital variable speed wall controller. The controller user interface shall be a wall-mounted, touch interface.
2. The controller shall be mounted to a standard rectangular or square outlet box.
3. A 150-ft CAT5 cable shall be provided for connecting the controller to the fan's VFD and to provide power to the controller.
4. The controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
5. The controller shall have an IP65 rating.
6. The controller shall provide fan start/stop, speed, and direction control functions.
7. The controller shall provide diagnostic and fault history information for the connected fan, as well as the ability to configure fan parameters with the assistance of Big Ass Fans Customer Service.
8. The controller interface shall be able to be secured with a passcode to prevent unauthorized access to fan controls and settings.
9. The controller shall operate out of the box without setup and upon connection to CAT5 cable.

K. BAFCon Controller (Optional)

1. The fan shall have the option of operating with the BAFCon controller.
2. The digital controller user interface shall be a wall-mounted touchscreen with a 5-inch display and an 800 (RGB) x 480 pixel resolution.
3. The digital controller shall be mounted to a standard rectangular or square outlet box.
4. A 150-ft CAT5 cable shall be provided for connecting the digital controller to the fan's VFD, allowing for seamless communication between BAFCon and the VFD. The cable shall provide power to the digital controller.
5. The digital controller shall not require a 120 V power supply at the controller mounting location.
6. The digital controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.
7. The digital controller shall support up to eight Powerfoil D fans controlled as a group or individually.
8. The digital controller shall provide fan start/stop, speed, and direction control functions.
9. The digital controller shall provide diagnostic and fault history information for each connected fan as well as the ability to configure fan parameters with the assistance of Big Ass Fans Customer Service.

10. The digital controller shall include optional SmartSense functionality to maximize energy savings. SmartSense shall provide the capability to automatically control the speed of Big Ass Fans using information from user-determined settings and built-in temperature and humidity sensors.
11. The digital controller interface shall be able to be secured with user and admin passcodes to prevent unauthorized access to fan controls and settings.
12. The digital controller shall include Bluetooth® functionality for receiving firmware updates from a mobile app. The app shall be supported by iOS® and Android™ mobile devices. The digital controller's Bluetooth functionality can be disabled if not needed or permitted.
13. BAFCon Multi-Fan Accessory Kit (Optional)
    a. If multiple fans will be installed, the BAFCon Multi-Fan Accessory Kit shall be available.
    b. The kit shall include a two-screw RJ45 terminal block, a ¼ Watt, 120 Ohm termination resistor, RJ45 pass through splitters, and split-gland cord grips for connecting multiple fans to the controller.
    c. The accessory kit shall include a two-screw RJ45 terminal block, a ¼ Watt, 120 Ohm termination resistor, RJ45 pass through splitters, and split-gland cord grips for daisy chaining multiple fans to the controller.

L. Fire Alarm Control Panel Integration

1. Includes a 10-30 VDC pilot relay for seamless fire control panel integration. The pilot relay can be wired Normally Open or Normally Closed in the field.

M. Guy Wires

1. Included for installations with extension tubes 4 ft or longer to limit the potential for lateral movement.

2.3 HIGH VOLUME, LOW SPEED FANS - BIG ASS FANS BASIC 6

A. Complete Unit

1. Regulatory Requirements: The entire fan assembly shall be Intertek/ETL-certified and built pursuant to the construction guidelines set forth by UL 507 and CSA C22.2 No. 113.
2. Sustainability Characteristics: The fan shall be designed to move an effective amount of air for cooling and destratification in industrial applications over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. Sound levels from the fan operating at maximum speed measured in a laboratory setting shall not exceed 55 dBA. Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.
3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.

B. Airfoil System

1. The fan shall be equipped with six (6) Powerfoil airfoils of precision extruded aluminum alloy. The airfoils shall be connected by means of two (2) high strength locking bolts per airfoil. The airfoils shall be connected to the hub and interlocked with zinc plated steel retainers.
2. The fan shall be equipped with six (6) Powerfoil winglets on the ends of the airfoils. The winglets shall be molded of a polypropylene blend. The standard color of the winglet shall be "Safety Yellow." Color shall be as scheduled and shall be coordinated with the architect and owner prior to ordering.

C. Motor

1. The fan motor shall be an AC induction type inverter rated at 1725 RPM, 200-240/460-480 VAC, 60 Hz, three-phase.
2. The motor shall be totally enclosed, fan cooled (TEFC) with an IP56. A B5 standard frame shall be provided for ease of service. The motor shall be manufactured with a double baked Class F insulation and be capable of continuous operation in 5degreesF to 104 degrees F ambient conditions.

D. Gearbox

1. The gearbox shall be a helical gear reducer, precision finished from hardened steel for low noise and long service life with double lip seals to retain oil and prevent contamination. The gearbox shall be lubricated for life. The gear reducer shall have a standard backlash of less than 25 arc minutes and be equipped with a 17-4 stainless steel shaft of 1-1/4" diameter.

E. Motor Frame

1. The motor frame and mount shall be constructed of steel and powder coated for corrosion resistance and appearance.

F. Mounting System

1. The fan mounting system shall be designed for quick and secure installation on a variety of structural supports. The design of the upper mount shall provide two axes of rotation. This design shall allow for adjustments to be made after the mount is installed to the mounting structure to ensure the fan will hang level from the structure.
2. The upper mount shall be of ASTM A36/A36M steel, welded construction, at least 3/16" thick, and powder coated for appearance and corrosion resistance. No mounting hardware or parts substitutions, including cast aluminum, are acceptable.
3. All mounting bolts shall be SAE Grade 8 or equivalent.

G. Hub

1. The fan hub shall be 19” in diameter and shall be made of precision cut aluminum for high strength and light weight. The hub shall consist of two (2) aluminum plates, six (6) aluminum spars, and one (1) aluminum spacer fastened with a pin and collar rivet system. The overall design shall provide a flexible assembly such that force loads experienced by the hub assembly shall be distributed over a large area to reduce the fatigue experienced at the attachment point for the fan blade.
2. The hub shall be secured to the output shaft of the gearbox by means of a steel coupling interface. The hub shall incorporate three (3) safety retaining clips made of 1/4” thick steel that shall restrain the hub/airfoil assembly.

H. Safety Cables

1. The fan shall be equipped with an upper safety cable that provides an additional means of securing the fan assembly to the building structure. The upper safety cable shall have a diameter of 3/8”.
2. The fan shall be equipped with two lower safety cables pre-attached to the fan hub that shall provide an additional means of securing the fan to the extension tube. The lower safety cables shall have a diameter of 1/4”.
3. The safety cables shall be fabricated out of 7 x 19 galvanized steel cable. The end loops shall be secured with swaged Nicopress® sleeves, pre-loaded and tested to 3,200 lbf.
4. Field construction of safety cables is not permitted.

I. Variable Frequency Drive

1. The Variable Frequency Drive (VFD) shall be a NEMA 4X VFD that is factory programmed to minimize starting and braking torques. The VFD shall have touchpad controls and an LED display for controlling the fan’s direction, operation, speed, and programming. The VFD may be equipped with an EMI/RFI filter to limit interference with other electronic equipment and a rotary switch disconnect for lock-out/tag-out requirements.
2. Onboard Variable Frequency Drive: The VFD may be mounted on the fan motor frame. A wall-mounted remote keypad equipped with touchpad controls and an LED display shall be provided for such installations, allowing access to all VFD functions.
3. Wall-Mounted Variable Frequency Drive: The VFD may be wall-mounted for ease of access.

J. Fire Control Panel Integration

1. Includes a 10-30 VDC pilot relay for seamless fire control panel integration. The pilot relay can be wired Normally Open or Normally Closed in the field.

K. Guy Wires

1. Included for installations with extension tubes 4 ft or longer to limit the potential for lateral movement.

2.4 HIGH VOLUME, LOW SPEED FANS - FANS SCHEDULED AS BIG ASS FANS ESSENCE

A. Complete Unit

1. Regulatory Requirements: The entire fan assembly shall be Intertek/ETL-certified and built pursuant to the construction guidelines set forth by UL 507 and CSA C22.2 No. 113.
2. Sustainability Characteristics: The fan shall be designed to move an effective amount of air for cooling and destratification of conditioned commercial applications over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. Sound levels from the fan operating at maximum speed measured in a laboratory setting shall not exceed 40 dBA. Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.
3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.

B. Controls

1. The fan controller shall be incorporated into the fan assembly and housed in an enclosure independent of the motor to prevent overheating or electrical interference. The fan controller shall be factory programmed to minimize starting and braking torques and shall be equipped with a simple diagnostic program and an LED light to identify and relay faults in the system.

C. Airfoil System

1. The fan shall be equipped with eight (8) high volume, low speed airfoils of precision extruded, anodized aluminum alloy. Each airfoil shall be of the high-performance Mini-Elipto design. The airfoils shall be connected to the hub and interlocked with eight (8) stainless steel retainers and two (2) sets of stainless steel bolts and lock washers per airfoil.
2. The fan shall be equipped with eight (8) upswept winglets designed to redirect outward airflow downward, thereby enhancing efficiency. The winglets shall be molded of high strength polymer and shall be attached at the tip of each airfoil with a stainless steel screw. The standard color of the winglets shall be silver or black. Color shall be as scheduled and shall be coordinated with the architect and owner prior to ordering.
3. As an option, the fan shall be equipped with eight (8) plug-style airfoil tips, molded of high strength polymer, in place of the eight (8) upswept winglets. The airfoil tips shall be attached at the tip of each airfoil with a stainless steel screw. The standard color of the airfoil tips shall be black. Color shall be as scheduled and shall be coordinated with the architect and owner prior to ordering.

D. Motor

1. The motor shall be a permanent magnet brushless motor rated for continuous operation at maximum speed with the capability of modulating the fan speed from 0-100% without the use of a gearbox or other mechanical means of control.
2. The motor shall operate from any voltage ranging from 100-120 VAC or 200-240 VAC, single phase, and 60Hz, without requiring adapters or customer selection. The motor shall be a non-ventilated, heat sink design with the capability of continuous operation in -4°F to 131°F ambient condition.
3. The motor shall be rated IP43.
4. The standard color of the motor unit shall be white with silver trim or silver with black trim.

E. Mounting System

1. The fan mounting system shall be designed for quick and secure installation from a variety of structural supports. All components in the mounting system shall be of formed metal design using low-carbon steel no less than 3/16" thick and containing no critical welds. The mounting system shall be powder coated for appearance and resistance to corrosion. All mounting bolts shall be metric stainless steel or equivalent. No mounting hardware substitutions, including cast aluminum, are acceptable.
2. The fan extension tube shall be a round, extruded aluminum tube. The extension tube shall include a chrome plate with forward and reverse controls and a fan status indicator light that is visible from the floor.

F. Hub

1. The fan hub shall be constructed of zinc plated steel for high strength and durability. The hub shall be precision machined to achieve a well-balanced and solid rotating assembly.

G. Safety Cable

1. The fan shall be equipped with a safety cable that provides an additional means of securing the fan assembly to the building structure. The safety cable shall be 3/16" diameter and fabricated out of 7 x 19 stranded galvanized steel, pre-loaded and tested to 3,200 lbf.
2. Field construction of safety cables is not permitted.

H. Wall Control

1. Wired (standard). The fan shall be equipped with a low-voltage wired remote wall control providing control of all fan functions. The wall control shall be capable of mounting to a standard electrical box or directly to a wall surface. The wall control shall include a rotary-style dial for controlling the fan's power and speed and an LED light to identify and relay faults in the system. Communication with the fan drive and controller shall be by a standard, commercially available CAT5 (or higher) Ethernet cable that is field installed and provided by the installer.
2. Wireless (optional). As an option, the fan shall be equipped with an optional radio frequency (RF) remote wall control in place of the wired wall control. The wall control shall provide control of all fan functions. The wall control shall be capable of mounting to a standard electrical box with an owner-supplied wall plate and shall include a capacitive touch display for controlling the fan's power and speed. Communication with the fan drive and controller shall be wireless.

I. Fire Control Panel Integration

1. Includes a 10-30 VDC pilot relay for seamless fire control panel integration. The pilot relay can be wired Normally Open or Normally Closed in the field.

J. Guy Wires

1. Guy wires shall be included for installations with extension tubes 4 ft or longer to limit the potential for lateral movement.

PART 3 - EXECUTION

3.1 PREPARATION

A. Fan location must have a typical bar joist or existing I-beam structure from which to mount the fan. Additional mounting options may be available.

B. Mounting structure must be able to support weight and operational torque of fan. Consult structural engineer if necessary.

C. Fan location must be free from obstacles such as lights, cables, or other building components.

D. Check fan location for proper electrical requirements. Consult installation guide for appropriate circuit requirements.

E. Each fan requires dedicated branch circuit protection.

F. Before the BAFCon controller is installed, the fan system shall be installed by a factory-certified installer according to the instructions in the fan Installation Guide.

G. Install a rectangular or square outlet box at the BAFCon controller mounting location.

H. If the BAFCon controller will be mounted more than 250 ft from the fan or if multiple fans will be daisy chained, ensure the optional BAFCon Accessory Kit is included. The accessory kit shall be installed by a factory- certified installer according to the instructions included with the kit.

3.2 INSTALLATION

A. The fan and BAFCon controller shall be installed by a factory-certified installer according to the manufacturer's Installation Guide, which includes acceptable structural dimensions and proper sizing and placement of angle iron for bar joist applications. Contractor shall consult a structural engineer for installation methods outside the manufacturer's recommendation and a certification, in the form of a stamped print or letter, submitted prior to installation.

B. Minimum Distances

1. Airfoils must be installed at a minimum distance above the floor as recommended by the fan manufacturer.
2. Installation area must be free of obstructions such as lights, cables, sprinklers or other building structures with the airfoils at least 2 ft clear of all obstructions.
3. The structure the fan is attached to shall be capable of supporting the operational torque load indicated by the fan manufacturer.

C. The fan shall not be located where it will be continuously subjected to wind gusts or in close proximity to the outputs of HVAC systems or radiant heaters.

D. In buildings equipped with sprinklers, including ESFR sprinklers, fan installation shall comply with all of the following:

1. The maximum fan diameter shall be 24 ft.
2. The HVLS fan shall be centered approximately between four adjacent sprinklers.
3. The vertical clearance from the HVLS fan to the sprinkler deflector shall be a minimum of 3 ft.
4. All HVLS fans shall be interlocked to shut down immediately upon receiving a waterflow signal from the alarm system in accordance with the requirements of NFPA 72.

E. Mount the BAFCon controller to a flat, readily accessible surface that is free from vibration and away from foreign objects and moving equipment. The controller mounting location must meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.

F. If the SmartSense feature will be used, the BAFCon controller must not be mounted adjacent to or above a radiant heat source, near HVAC ventilation intakes/exhausts, on a poorly insulated exterior wall, or in a different temperature/humidity environment than the fans it will control. Additional mounting guidelines can be found in the Installation Guide.

END OF SECTION

SECTION 23 37 13

AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Ceiling air diffusers.

B. Wall registers and grilles.

C. Louvers.

D. Other air devices indicated on drawings and schedules.

1.2 RELATED SECTIONS

A. Section 08 91 00 - Louvers

B. Section 23 02 00 - Basic Materials and Methods for HVAC

C. Section 23 05 93 - Testing, Adjusting, And Balancing

D. Section 23 07 13 - Duct Insulation

E. Section 23 31 13 - Metal Ductwork

F. Section 23 33 00 - Ductwork Accessories

1.3 REFERENCES

A. AHRI 880 (I-P) - Performance Rating of Air Terminals.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating.

C. AMCA 540 - Test Method for Louvers Impacted by Wind Borne Debris.

D. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers.

E. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets.

F. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

I. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

J. ASTM D870 - Standard Practice for Testing Water Resistance of Coatings Using Water Immersion.

K. ICC (IBC) - International Building Code.

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air distribution devices of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. AHRI Compliance: Test and rate air distribution devices in accordance with AHRI 880 (I-P).
2. ASHRAE Compliance: Test and rate air distribution devices in accordance with ASHRAE Std 70.
3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500-L.
4. AMCA 540 - Test Methods for Louvers Impacted by Wind Borne Debris with Enhanced Protection Approval.
5. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers.
6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
7. NFPA Compliance: Install air distribution devices in accordance with NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
10. IBC - International Building Code.
11. IMC - International Mechanical Code.
12. UMC - Uniform Mechanical Code.

1.5 DEFINITIONS

A. Hurricane-prone regions:

1. The U.S. Atlantic Ocean and Gulf of Mexico coasts where the ultimate design wind speed for Risk Category II Buildings is greater than 115 mph;
2. Hawaii, Puerto Rico, Guam, Virgin Islands and American Samoa.

B. Wind-borne debris region: Areas within hurricane-prone regions located:

1. Within 1 mile of the coastal mean high water line where the ultimate design wind speed is 130 mph or greater; or
2. In areas where the ultimate design wind speed is 140 mph or greater. For Risk Category II buildings and structures and Risk Category III building and structures, except health care facilities, the wind-borne debris region shall be based on Figure 1609.3(1). For Risk Category IV buildings and structures and Risk Category III health care facilities, the wind-borne debris region shall be based on Figure 1609.3(2).

C. Ultimate design wind speed - The ultimate design wind speed for the determination of the wind loads shall be determined by Figures 1609.3(1), 1609.3(2) and 1609.3(3) of ICC (IBC).

1.6 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for the following:

1. Air Distribution Devices
   a. Schedule of air distribution devices indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
   b. Data sheet for each type of air distribution devices, and accessory furnished; indicating construction, finish, and mounting details.
   c. Performance data for each type of air distribution devices furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
2. Louvers
   a. Manufacturer's product data including performance data.
   b. Preparation instructions and recommendations.
   c. Storage and handling requirements and recommendations.
   d. Installation methods.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air distribution device and louver, indicating materials, construction, dimensions, accessories, and installation details.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air distribution devices wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air distribution devices and louvers in original cartons and protect from weather and construction work traffic in accordance with manufacturer’s instructions. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.8 WARRANTY

A. Warrant the installation of the work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or nonconforming workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - AIR DEVICES

A. Titus Company

B. Metalaire Industries, Inc.

C. Nailor Industries

D. Krueger

E. Price

2.2 AIR DEVICES

A. Unless otherwise indicated, provide manufacturer's standard air devices when shown of size, shape, capacity, type and accessories indicated on drawings and schedules, constructed of materials and components as indicated and as required for complete installation and proper air distribution.

B. Provide air devices that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

C. Unless noted otherwise on drawings, the finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50 inch-pound force applied.

D. Provide air device with border styles that are compatible with adjacent ceiling or wall system, and that are specially manufactured to fit into the wall construction or ceiling module with accurate fit and adequate support. Refer to architectural construction drawings and specifications for types of wall construction and ceiling systems.

E. Provide integral volume damper with roll formed steel blades where indicated on drawings or schedules. Dampers shall be opposed blade design with a screwdriver slot or a concealed lever operator for adjustment through the face of the air device.

F. Air devices designated for fire rated systems shall be pre-assembled with UL classified radiation damper and thermal blanket. Fire rated air devices shall be shipped completely assembled, one assembly per carton; each assembly shall be enclosed in plastic shrink wrap with installation instructions.

2.3 ACCEPTABLE MANUFACTURERS - LOUVERS

A. Ruskin Manufacturing Company

B. Greenheck Company

C. Louvers and Dampers, Inc.

D. Pottorff

E. Arrow

2.4 LOUVERS

A. Louvers not located in hurricane-prone regions or wind-borne debris regions shall meet the requirements of AMCA 500-L for Laboratory Methods of Testing Louvers for Rating and be drainable stationary type louvers.

B. Louvers located in hurricane-prone regions shall meet the requirements of AMCA 550 for High Velocity Wind Driven Rain without the use of a control damper.

C. Louvers located in wind-borne debris regions within 30 feet of grade shall meet the requirements of AMCA 540 for Large Missile Impact.

D. Provide louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

E. Provide louvers that have minimum free area and maximum pressure drop as indicated on drawings.

F. Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to architectural construction drawings and specifications for types of substrate.

G. Coordinate with Architect for finish and color.

H. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All interior surfaces of all air devices shall be painted flat black.

B. See floor plans for type, neck size and CFM of air for all air distribution devices.

C. Install all air distribution devices as detailed on plans and in accordance with manufacturer’s recommendations.

D. The backside of all air devices shall be insulated with taped and sealed external duct wrap to match the insulation thickness and R-value of the ductwork connecting to the air device. Refer to 23 07 13 - Duct Insulation.

E. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

F. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

G. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.

H. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

I. Touch-up, repair or replace any damaged products prior to substantial completion.

END OF SECTION

SECTION 23 41 00

AIR FILTERS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC are included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 REFERENCES

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

B. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality.

PART 2 - PRODUCTS

2.1 FILTERS

A. Air filters shall be high efficiency ASHRAE pleated panels consisting of synthetic media, welded wire media support grid, and beverage board enclosing frame, AAF PREpleat M13, 2-inch thick or approved equal.

B. APPROVED MANUFACTURERS

1. American Air Filter.
2. Camfil.
3. Airguard Industries, Inc.
4. Cambridge.
5. Filtration Group

2.2 LOW VELOCITY FILTER SECTION

A. Filters shall be of the throwaway cartridge type in 2-inch frames. When installing multiple filters into slide-in frames tape adjacent filters together with duct tape to prevent bypassing of air around the filter. Media shall be rated at 500 feet per minute.

B. Filtering media shall be formed of non-woven reinforced synthetic type filtering media bonded to 96% open area media support grid folded into a non-creased radial pleat design. The filter pack shall be bonded to the enclosing frame to prevent air bypass. Minimum Efficiency Reporting Value of MERV 13 when evaluated under the guidelines of ASHRAE Std 52.2. Initial resistance shall not exceed 0.30 inches water gauge at 500 fpm face velocity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Filters shall be provided upstream of all cooling coils or other devices with wetted surfaces through which air is supplied to occupiable spaces per ASHRAE Std 62.1.

B. Install differential pressure switch to activate "Filter Dirty" light when pressure difference across filters reaches 0.5 inches w.g. (adjustable). Locate "filter dirty" lights in mechanical rooms with identifying label.

C. Refer to Section 23 02 00 for additional filter information.

END OF SECTION

SECTION 23 55 00

FUEL FIRED UNIT HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Tubular infrared heaters.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 23 09 63 - Energy Management and Control System (EMCS): Installation of thermostats and other controls components.

B. Section 26 29 26 - Miscellaneous Electrical Controls and Wiring: Installation and wiring of thermostats and other controls components.

1.3 RELATED SECTIONS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping.23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

C. Section 23 07 13 - Duct Insulation

1.4 REFERENCES

A. ANSI Z223.1 - National Fuel Gas Code.

B. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers.

C. NFPA 31 - Standard for the Installation of Oil Burning Equipment.

D. NFPA 54 - National Fuel Gas Code.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

G. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.

H. ANSI/NEMA MG 1 - Motors and Generators.

1.5 SUBMITTALS

A. Submit under provisions of Division 1.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

D. Manufacturer's Installation Instructions: Indicate rigging, assembly, and installation instructions.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation data under provisions of Division 1.

B. Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

1.7 WARRANTY

A. Provide (1) a one-year warranty under provisions of Division 1.

B. Warranty: Include coverage for (5) five-year, non-prorated warranty for heat exchangers and draft diverters.

PART 2 - PRODUCTS

2.1 TUBULAR INFRARED HEATERS

A. Manufacturers:

1. Reznor
2. Detroit Radiant Products Company
3. Solaranics, Inc.
4. Space-Ray/SunStar, Gas-Fired Products, Inc.

B. Units: Packaged, factory assembled, pre- wired unit consisting of cabinet, burner, heat exchanger, radiant tube, reflector, controls.

C. Refer to Schedule. Gas heating capacities are sea level ratings.

D. Cabinet: Galvanized steel with baked enamel finish.

E. Heat Exchanger: Aluminized steel combustion chamber with aluminized steel tube with aluminum reflector.

F. Gas Burner: Forced draft type with adjustable combustion air supply, combination gas valve and pressure regulator incorporating manual shut- off, pilot valve, automatic 100 percent shut- off and thermo-couple pilot safety device, electronic pilot ignition.

G. Gas Burner Safety Controls: Thermo- couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.

H. Room Thermostat: Low voltage, to control burner operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available.

C. Verify that proper fuel supply is available for connection.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install to NFPA 90A and NFPA 90B.

C. Install gas fired units to ANSI Z223.1 (NFPA 54).

D. Install oil fired units to NFPA 31.

E. Provide vent connections to NFPA 211.

F. Install heaters with vibration isolation. Refer to Section 23 05 48.

END OF SECTION

SECTION 23 62 13.13 – DOAS AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC is included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.3 REFERENCES

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. AHRI 340/360 (I-P) - Standard for Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. ICC (IECC) - International Energy Conservation Code.

F. NFPA 70 - National Electrical Code.

1.4 QUALITY ASSURANCE

A. Unit shall be factory tested, shall be UL-labeled and rated in accordance with AHRI 920 (I-P).

B. Unit construction shall comply with ASHRAE Std 15.

C. Unit wiring shall comply with NFPA 70.

D. Unit shall meet or exceed minimum efficiency requirements in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P.

1.5 SUBMITTALS

A. Submit Shop drawings and product data under provisions of Division One.

B. Shop drawings shall indicate components, dimensions, weights, required service clearances, and location and sizes of field connections. Indicate equipment, piping and connections and accessories required for complete system.

C. Product data shall include rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

D. Submit manufacturer's installation instructions.

E. For roof mounted units provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation data.

B. Include start-up instructions, maintenance data, controls, and accessories. Include trouble-shooting guide.

C. Submit maintenance data.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site. Comply with manufacturer's installation instructions for rigging, unloading and transporting units.

B. Accept products on site and inspect for damage.

C. Protect units from physical damage. Factory shipping covers and skids shall be kept in place until installation. Store in a clean dry place and protect from weather and construction traffic.

1.8 WARRANTY

A. Provide the entire condensing unit with parts and labor warranty by the equipment manufacturer for one year from start-up or 18 months from date received on site.

B. Provide all components of the refrigeration circuit with parts and labor warranty by the equipment manufacturer for five years from date of on-site accepted delivery.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.

6. On site demonstration.

PART 2 - PRODUCTS

2.1 AIR-COOLED CONDENSING UNITS

A. Air-cooled condensing unit shall be designed for use with split system having a remote direct-expansion (DX) cooling coil mounted in evaporator fan unit and rated in accordance with AHRI 920 (I-P). Capacity shall be as called for on the Drawings when matched to the appropriate evaporator coil.

B. Condensing unit shall consist of high-efficiency compressors, air-cooled condenser with quiet fan, factory wired controls, R-454B refrigerant and refrigeration circuit and valves.

C. Cabinet shall be heavy-gauge galvanized steel with bonding primer and baked-enamel finish coat. The entire cabinet shall be protected from rust.

D. Compressors shall be R-454B scroll type with thermal overload protection, individually circuited and carry a 1 year non-prorated warranty, from the date of original equipment shipment from the factory.

E. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged access doors shall provide access to the compressors.

F. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of sound from the compressors into the building area.

G. 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, liquid line filter driers, and service valves for liquid and suction connections. Field installed refrigerant circuits shall include the low side cooling components, refrigerant, thermal expansion valve, liquid line, insulated hot gas line and insulated suction line.

H. Compressor shall be protected from excessive current and temperatures and shall be provided with a thermostatically controlled crankcase heater to operate only when needed for protection of the compressor. Compressor shall be mounted on resilient rubber isolators. Compressor shall be located in compartment isolated from condenser fan and coil. Provide a high-capacity dryer in the system to remove moisture and dirt.

I. Each capacity stage shall be equipped with a 5 minute off delay timer to prevent compressor short cycling. Each capacity stage shall be equipped with an adjustable 20 second delay timer to prevent multiple capacity stages from starting simultaneously.

J. Unit shall include a factory holding charge of R-454B refrigerant and oil. Adjusting the charge of the system will be required during installation.

K. Condenser fan shall be directly connected to a weather-protected, quiet, high-efficiency motor. Fan guard shall be provided and shall be protected from rust by PVC finish.

L. Condenser fans shall be low sound, high efficiency electronically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F. Condenser fan housing shall be fabricated of composite material and include an optimized orifice with inlet guide vanes. The condenser fan blade shall be serrated and aerodynamically designed for high efficiency and reduced sound levels. Fan motor shall be weather protected, single phase, direct drive, and totally enclosed air over with thermal overload protection.

M. Condenser coil shall be aluminum fin with copper tube.

N. Connections for refrigerant suction and liquid lines shall be extended outside the cabinet and provided with service valves with gauge connections.

O. Power connections shall be made to the connectors located inside the electrical connection box.

P. Standard operating and safety controls shall include high-pressure switch, low pressure switch, compressor overload service, and solid-state timed-off control.

Q. Lead refrigeration circuit(s) shall include a 10-100% variable capacity compressor.

R. Lead refrigeration circuit shall be provided with modulating hot gas reheat valve, electronic controller, liquid line receiver, supply air temperature sensor and a dehumidification control signal terminal that enables the dehumidification mode of operation and includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. The matching indoor air handler must include a hot gas reheat coil, a check valve on the hot gas reheat line, and a check valve on the liquid line.

S. Each refrigeration circuit shall be equipped with a liquid line sight glass.

T. Each compressor shall be provided with a compressor sound blanket.

2.2 AUXILIARY EQUIPMENT

A. Auxiliary equipment shall consist of refrigerant lines prepared for the unit involved. These lines shall be cleaned, dried, and pressurized at the factory.

B. Low ambient kit to allow operation at outside temperature below 35 deg. F (2 deg. C) shall be provided.

C. Expansion valve shall be provided with the evaporator coil.

D. Provide thermostat to match the requirements of the job. Thermostat shall provide subbase with Heat-Cool-Off and Fan On-Auto switch. See section on controls for other related requirements.

E. Provide polyethylene structural base designed for that service, and intended to support the unit and eliminate vibration transmission.

F. Provide hard-start kit with unit.

G. Provide guards for condenser coils.

H. Unit shall be provided with factory supplied and factory installed supervisory AAON VCCX controller in the compressor and controls compartment.

I. Unit shall be provided with factory supplied and factory installed CAV AAON VCCX controller in the matching AAON air handling unit.

2.3 ACCEPTABLE MANUFACTURERS

A. Aaon

B. Engineered Air

C. Munters

D. Desert Aire

PART 3 - EXECUTION

3.1 INSTALLATION

A. All HVAC equipment shall be installed as per manufacturer's printed installation instructions.

B. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C. All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer's requirements.

D. Install the condensing unit on proper foundation as shown on the Drawings, and in location that will not restrict the air entry or discharge from the unit.

E. Install refrigerant lines as recommended by the manufacturer, taking care not to lose the refrigerant charge contained in the lines, or allow air to enter the lines or equipment. Locate the lines in such a way as to not obstruct access to the condensing unit or other equipment. Lines located underground or under concrete shall be installed in a PVC sleeve for protection.

F. Provide electrical connections as required by the applicable codes. Provide control wiring required. All power wiring and control wiring shall be in conduit and located so as not to obstruct access to the unit or other equipment.

3.2 TESTING

A. Operate the condensing unit and the system to assure that unit is operating properly and without excessive noise and vibration.

B. Read and record the power draw and the refrigeration suction and liquid pressures as required by Section 23 05 93 - Testing, Adjusting, And Balancing.

END OF SECTION

SECTION 23 62 13

AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC is included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.3 REFERENCES

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. AHRI 340/360 (I-P) - Standard for Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. ICC (IECC) - International Energy Conservation Code.

F. NFPA 70 - National Electrical Code.

1.4 QUALITY ASSURANCE

A. Unit shall be factory tested, shall be UL-labeled and rated in accordance with AHRI 340/360 (I-P).

B. Unit construction shall comply with ASHRAE Std 15.

C. Unit wiring shall comply with NFPA 70.

D. Unit shall meet or exceed minimum efficiency requirements in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P.

1.5 SUBMITTALS

A. Submit Shop drawings and product data under provisions of Division One.

B. Shop drawings shall indicate components, dimensions, weights, required service clearances, and location and sizes of field connections. Indicate equipment, piping and connections and accessories required for complete system.

C. Product data shall include rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

D. Submit manufacturer's installation instructions.

E. For roof mounted units provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation data.

B. Include start-up instructions, maintenance data, controls, and accessories. Include trouble-shooting guide.

C. Submit maintenance data.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site. Comply with manufacturer's installation instructions for rigging, unloading and transporting units.

B. Accept products on site and inspect for damage.

C. Protect units from physical damage. Factory shipping covers and skids shall be kept in place until installation. Store in a clean dry place and protect from weather and construction traffic.

1.8 WARRANTY

A. Provide the entire condensing unit with parts and labor warranty by the equipment manufacturer for one year from start-up or 18 months from date received on site.

B. Provide all components of the refrigeration circuit with parts and labor warranty by the equipment manufacturer for five years.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.1 AIR-COOLED CONDENSING UNITS

A. Air-cooled condensing unit shall be designed for use with split system having a remote direct-expansion (DX) cooling coil mounted in evaporator fan unit and rated in accordance with either AHRI 210/240 or AHRI 340/360 (I-P). Capacity shall be as called for on the Drawings when matched to the appropriate evaporator coil.

B. Condensing unit shall consist of high-efficiency hermetic compressor, air-cooled condenser with quiet fan, factory wired controls, R410A or R407C refrigerant and refrigeration circuit and valves.

C. Cabinet shall be heavy-gauge galvanized steel with bonding primer and baked-enamel finish coat. The entire cabinet shall be protected from rust.

D. Compressor shall be protected from excessive current and temperatures and shall be provided with a thermostatically controlled crankcase heater to operate only when needed for protection of the compressor. Compressor shall be mounted on resilient rubber isolators. Compressor shall be located in compartment isolated from condenser fan and coil. Provide a high-capacity dryer in the system to remove moisture and dirt.

E. Condenser fan shall be directly connected to a weather-protected, quiet, high-efficiency motor. Fan guard shall be provided and shall be protected from rust by PVC finish. Condenser coil shall be aluminum fin with copper tube.

F. Connections for refrigerant suction and liquid lines shall be extended outside the cabinet and provided with service valves with gauge connections.

G. Power connections shall be made to the connectors located inside the electrical connection box.

H. Standard operating and safety controls shall include high-pressure switch, low pressure switch, compressor overload service, and solid-state timed-off control.

2.2 AUXILIARY EQUIPMENT

A. Auxiliary equipment shall consist of refrigerant lines prepared for the unit involved. These lines shall be cleaned, dried, and pressurized at the factory.

B. Low ambient kit to allow operation at outside temperature below 35 deg. F (2 deg. C) shall be provided.

C. Expansion valve shall be provided with the evaporator coil.

D. Provide thermostat to match the requirements of the job. Thermostat shall provide subbase with Heat-Cool-Off and Fan On-Auto switch. See section on controls for other related requirements.

E. Provide polyethylene structural base designed for that service, and intended to support the unit and eliminate vibration transmission.

F. Provide hard-start kit with unit.

G. Provide guards for condenser coils.

2.3 ACCEPTABLE MANUFACTURERS

A. Lennox

B. Carrier

C. York

D. Trane

PART 3 - EXECUTION

3.1 INSTALLATION

A. All HVAC equipment shall be installed as per manufacturer's printed installation instructions.

B. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C. All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer's requirements.

D. Install the condensing unit on proper foundation as shown on the Drawings, and in location that will not restrict the air entry or discharge from the unit.

E. Install refrigerant lines as recommended by the manufacturer, taking care not to lose the refrigerant charge contained in the lines, or allow air to enter the lines or equipment. Locate the lines in such a way as to not obstruct access to the condensing unit or other equipment. Lines located underground or under concrete shall be installed in a PVC sleeve for protection.

F. Provide electrical connections as required by the applicable codes. Provide control wiring required. All power wiring and control wiring shall be in conduit and located so as not to obstruct access to the unit or other equipment.

3.2 TESTING

A. Operate the condensing unit and the system to assure that unit is operating properly and without excessive noise and vibration.

B. Read and record the power draw and the refrigeration suction and liquid pressures as required by Section 23 05 93 - Testing, Adjusting, And Balancing.

END OF SECTION

SECTION 23 73 23 – INDOOR DOAS AIR HANDLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Indoor dedicated outdoor air system air handling unit.

1.2 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping

C. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

D. Section 23 05 26 - Variable Frequency Motor Speed Control for HVAC Equipment

E. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

F. Section 23 07 13 - Duct Insulation

G. Section 23 31 13 - Metal Ductwork

H. Section 23 33 00 - Ductwork Accessories

I. Section 23 34 00 - HVAC Fans

J. Section 23 41 00 - Air Filters

1.3 REFERENCES

A. AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment.

B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

C. AHRI 430 (I-P) - Performance Rating of Central Station Air-Handling Units.

D. AHRI 920 (I-P) - Performance Rating of Direct Expansion-dedicated Outdoor Air System Units.

E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

G. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.

H. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants.

I. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality.

J. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

K. ICC (IECC) - International Energy Conservation Code.

L. NEMA MG 1 - Motors and Generators.

M. NFPA 70 - National Electrical Code.

N. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.4 QUALITY ASSURANCE

A. Unit performance shall be certified in accordance with AHRI 920 (I-P) for Direct Expansion-dedicated Outdoor Air System Units.

B. Coil performance shall be certified in accordance with AHRI 920.

C. Direct-expansion coils shall be designed and tested in accordance with ASHRAE Std 15 Safety Code for Mechanical Refrigeration.

D. Insulation and insulation adhesive shall comply with NFPA 90A requirements or flame spread and smoke generation.

E. Unit shall be rated for sound performance in accordance with AHRI 260 and AMCA 300.

F. Unit shall be safety certified by ETL and be ETL US listed.

G. Unit shall be provided to comply with the maximum allowable fan horsepower per ICC (IECC) and ASHRAE Std 90.1 I-P.

1.5 GENERAL DESCRIPTION

A. Indoor mounted, central station air handling unit designed to provide 100% outside air to decentralized units or a conditioned space as required to meet specified performance requirements for ventilation, heating, cooling, filtration, and distribution. Unit shall be assembled for horizontal/vertical application and arranged to discharge conditioned air as shown on the drawings. Units shall be supplied by the specified manufacturer.

1.6 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Shop drawings shall indicate assembly, unit dimensions, weight loading, required clearances, construction details, and field connection details.

C. Product data shall indicate dimensions, weights, capacities, ratings, fan performance, motor electrical characteristics, and gauges and finishes of materials.

D. Provide fan curves with specified operating point clearly plotted.

E. Submit product data of filter media, filter performance data, filter assembly, and filter frames.

F. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory installed and field installed wiring.

G. Submit manufacturer's installation instructions under provisions of Division One.

H. Submit operation and maintenance data under provisions of Section 23 02 00.

I. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.7 WARRANTY

A. The air handling unit manufacturer shall warrant parts and labor for a period of eighteen (18) months from date of shipment, or twelve (12) months from date of start-up, whichever occurs first.

1.8 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled in accordance with the unit manufacturer's instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, and fan has been test-run under observation.

1.10 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Aaon

B. Engineered Air

C. Munters

D. Desert Aire

E. Substitute equipment may be considered for approval that includes at a minimum:

1. R-454B refrigerant
2. Double wall cabinet construction
3. Insulation with a minimum R-value of 6.25
4. Double sloped stainless steel drain pans
5. Hinged access doors with lockable handles
6. (ECM driven) (VFD driven) direct drive backward curved plenum supply fans
7. Control compartment LED service lights
8. Designed, engineered, and manufactured in the United States of America
9. All other provisions of the specifications must be satisfactorily addressed

2.2 GENERAL DESCRIPTION

A. Unit shall be factory supplied, central station air handler suitable for the capacities and configurations as shown on drawings. Unit may consist of a fan and coil section with a factory installed chilled water or direct-expansion coil, hot-gas reheat coil, heating coil section, electric heat section, face and bypass section, filter section, access section, mixing box or combination filter-mixing box, return fan, diffuser, or air blender as indicated on the drawings.

B. All sections, whether assembled into a unit or supplied as separate components, shall have mating flanges for bolted assembly. The flange shall extend around the complete perimeter of each section. The manufacturer shall supply bolts and sufficient closed cell gasket for full perimeter coverage.

2.3 CASING

A. All unit sections shall be supplied with a formed galvanized steel perimeter base rail of at least 6 inches in height designed to support the weight and structural integrity of the unit. Condensate drain connection will not penetrate the base rail. If external isolators are not used, provide 6 inch minimum height housekeeping pads or sufficient overall height to provide p-trap with 1 inch greater that unit total static pressure.

B. Unit panels for all sections shall be double wall construction and shall be constructed of minimum 18 gauge G90 mill galvanized steel. Casing panels shall be fully removable for easy access to the unit, and shall be secured to structural frame with aluminized or cadmium plated screws. Removal of panels must not affect the structural integrity of the unit. All panels shall have a minimum of 2-inch thick foam insulation (R-13). All panels shall be completely gasketed prior to shipping.

C. Casing air leakage shall not exceed Leakage Class 6 per ASHRAE Std 111 at +/- 8” w.g. Specified air leakage shall be accomplished without the use of caulk. Total estimated air leakage shall be reported for each unit in CFM, as a percentage of supply air, and as an ASHRAE Std 111 Leakage Class in the submittal. Unit casing (wall/floor/roof panels and doors) shall be able to withstand up to 1.5 times design static pressure, or 8” w.g., whichever is less, and shall not exceed 0.0042” per inch of panel span (L/240). Floor panels shall be double-wall construction and designed to support a 300 lb. load during maintenance activities and shall deflect no more than 0.0042” per inch of panel span.

D. Double wall hinged removable access doors with multiple handles shall be provided in the fan, coil, and filter sections on the drive side of the unit. Access doors must also be provided in all sections where the removal of sheet metal screws is required for unit access. Doors shall be of the same thickness and construction as the wall panels. A gasket shall be provided around the entire door perimeter. Access sections shall be installed where indicated on the drawings and shall be double walled hinged door.

2.4 ELECTRICAL

A. Unit shall be provided with a standard power block for connecting power to the unit.

B. Unit shall include a factor installed 24V control circuit transformer.

C. Unit shall include high and low voltage quick connects if shipped in sections.

D. Unit shall have a 5kAIC SCCR.

E. Unit shall be provided with phase and brownout protection which shuts down all electrical components in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage or on phase reversal.

F. Unit shall be provided with remote safety shutdown terminals for wiring to a field installed smoke detector, firestat, or building safety automatic shutdown system.

2.5 FANS

A. Units shall be provided with direct-driven, single-width, single-inlet (SWSI) airfoil plenum fans constructed per AMCA requirements for the duty specified. Class I fans are not acceptable. Fan wheels shall be aluminum construction and rated in accordance with and certified by AMCA 210. All fans shall be selected to deliver the specified airflow quantity at the specified operating Total Static Pressure and specified fan/motor speed. The fan shall be selected to operate at a system Total Static Pressure that does not exceed 90% of the specified fan's peak static pressure producing capability at the specified fan/motor speed. Fans shall be selected such that the operating speed at peak design airflow conditions is not greater than 25% above the associated motor synchronous speed. Fans driven by motors operated by variable frequency drive shall not exceed the maximum fan RPM allowed by the manufacturer under a bypass condition. Each fan/motor assembly shall include a minimum 14 gauge spun steel fan inlet funnel, and a G90 galvanized steel motor support plate and fan base with 2" spring type vibration isolation. Provide horizontal spring type thrust restraints between the unit casing and each fan/motor assembly.

B. Units delivering supply airflow rates of significant magnitude shall be equipped with multiple supply fans in an array configuration. Refer to scheduled values to verify motor quantity per unit. Where multiple fans are provided, backdraft dampers shall be mounted upstream of each fan for isolation and a single source power motor control panel shall be factory installed. All fans shall be factory-wired to motor control panel which shall consist of individual motor overload relays and on-off disconnect switch for power isolation.

2.6 MOTORS

A. All motors shall be premium efficiency, totally enclosed fan-cooled (TEFC), selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. Motors shall meet the requirements of NEMA MG 1 Part 30 and 31, section 4.4.2. Motor HP shall not exceed the scheduled HP as indicated in the AHU equipment schedules.

B. All fan motors shall be operated from variable frequency drives. Variable frequency drives shall be furnished, installed, and wired by the installing Contractor. Reference Section 23 05 26 - Variable Frequency Motor Speed Control for HVAC Equipment for additional VFD requirements. A factory inverter drive balance shall be performed on all air handling units to identify resonant frequencies. A report of the results shall be provided for unit startup purposes.

C. All motors operated by variable frequency drive shall be equipped with a maintenance free, conductive microfiber, shaft grounding ring with a minimum of two rows of circumferential microfibers to discharge electrical shaft currents within the motor and/or its bearings.

2.7 COILS

A. All coils shall be tested at 300 psig air pressure, under water.

B. All coils shall be installed on tracks for easy removal from the air handling unit. Units that require disassembly of the unit for coil removal are not acceptable.

C. Coils shall be aluminum plate fin type with belled collars and shall be bonded to 1/2 inch or 5/8 inch OD copper tubes by mechanical expansion. Coils shall have headers with steel MPT connections. Working pressure shall be 250 psig at 300°F.

D. All coil segments shall be furnished with 304 stainless steel coil casings and 304 stainless steel coil supports.

E. Coils shall be drainable and have non-trapping circuits. Headers shall have drain and vent connections extended to the outside of the unit casing. Supply and return headers shall be clearly labeled on the outside of the unit. Provide grommets at all pipe penetrations through cabinet.

F. Main drain pan shall be double wall stainless steel with minimum 2 inch insulation, sloped toward drain fitting, with integral elbow for side discharge and FPT connection, and shall comply with ASHRAE Std 62.1. A maximum of one drain shall be supplied for each cooling coil section which shall extend at least 18” downstream of the coil. The unit design shall not require a drain pan in any downstream section to contain the coil condensate. Moisture shall not carry over past the coil. Moisture eliminators are not acceptable for moisture carryover prevention.

G. Direct expansion coils shall be furnished with a brass distributor with solder type connections. Suction and discharge connections shall be on the same end regardless of rows deep. Coils shall have intertwined circuits for equal operation on each circuit. Provide the number of distributors equal to the amount of refrigerant circuits to the associated condensing unit. Direct expansion coil shall be selected to match the saturated suction temperature and capacity of the associated condensing unit.

H. Maximum face velocity across cooling coils shall be 500 FPM, unless noted otherwise on equipment schedule.

I. Coils in series shall have a minimum of 14 inch access section between coil casings.

J. In units larger than 10,000 cfm, coils shall be removable through a service panel without disassembly of the unit.

2.8 ELECTRIC HEATING

A. Unit shall include an electric heater consisting of electric heating coils, fuses, contactors, and a high temperature limit switch, with capacities as shown on the plans.

B. Heater shall have fully modulating capacity controlled by an SCR (Silicon Controlled Rectifier). A 0-10 VDC heating control signal shall be field provided to control the amount of heating.

C. Electric heating coils shall be located in the reheat position downstream of the supply fans.

D. Electric heating access shall be through service access door with piano hinges and lockable quarter turn handle.

2.9 FILTERS

A. Filter section shall accept 2 inch or 4 inch filters of standard sizes as indicated on drawings and shall be designed and constructed to house the type of filter specified. Section shall include side access slide rails.

B. Unit filter access shall be through service access door with piano hinges and quarter turn button fasteners.

C. A magnahelic differential pressure gauge shall be factory installed and flush mounted on drive side to measure the pressure drop across the filter.

D. A dirty filter allowance of 0.50” w.g. shall be incorporated into the total static pressure calculation of each air handling unit filter section.

E. Reference Section 23 41 00 - Air Filters for additional requirements.

2.10 CONTROLS

A. Factory Installed Aaon Orion Controller

1. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.
2. Controller shall be capable of stand-alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
3. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
4. Controller shall include non-volatile memory to retain all programmed values, without the use of an external battery, in the event of a power failure.
5. Make Up Air Controller
   a. Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.
   b. Hot gas bypass shall be required on the lead refrigeration circuits of systems without variable capacity compressors.
   c. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet outside air humidity loads and prevent supply air temperature swings and overcooling of the space.
   d. Unit shall modulate heating with constant airflow to meet ventilation outside air loads. Heating capacity shall modulate based on supply air temperature.
6. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks, BACnet network, or AAON Orion Controls System.

2.11 ACCESSORIES

A. All damper blades shall be galvanized steel, double skin airfoil type, housed in a galvanized steel frame and mechanically fastened to a hex axle rod rotating in stainless steel bearings. Dampers shall be sectionalized to limit blade length to no more than 48 inches so as to minimize blade warpage. Blade seals are required to assure tight closure. The damper shall be rated for a maximum leakage rate of 1 percent of nominal airflow at 1 inch w.g.

PART 3 - EXECUTION

3.1 INSTALLATION

A. If floor mounted air handling units are furnished with internal vibration isolation option, provide 2" thick Amber/Booth type NRC ribbed neoprene pads or approved equal to address high frequency breakout and provide additional unit elevation with overall sufficient height to provide p-trap with one inch greater than the unit total static pressure. Ribbed neoprene pads shall be located in accordance with the air handling unit manufacturer's recommendations. Condensate drain connection shall not penetrate the base air handling unit's rail.

B. Install in accordance with manufacturer's instructions.

C. All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

D. Make electrical connections, taking care that these do not block access to any part of the equipment requiring service.

E. Unit wiring shall comply with NFPA 70 and all applicable UL standards.

F. Connect full size condensate drain pipe to air handling unit and extend to nearest drain. Pipe shall be schedule 40 galvanized steel with malleable iron screwed fittings.

G. Unit installation shall comply with NFPA 90A requirements.

H. System Startup Requirements: The installing Contractor service technician shall startup all air handling units. Technician shall at a minimum perform the following steps for each unit:

1. Energize the unit disconnect switch.
2. Verify correct voltage, phases and cycles.
3. Energize fan motor and verify correct direction of rotation.
4. Re-check damper operation: verify that unit cannot and will not operate with all dampers in the closed position.
5. Energize fan motors and verify that motor FLA is within manufacturer's tolerance of nameplate FLA for each phase.
6. Program unit VFD to skip or lockout resonant frequencies that were identified by the manufacturer's factory inverter drive balance to prevent the VFD from continuously operating at these frequencies.

I. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fans have been test run under observation.

J. The installing Contractor shall comply with manufacturer's start-up requirements to ensure safe and correct operation.

END OF SECTION

SECTION 23 81 26

DUCTLESS SPLIT SYSTEM UNITS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 WORK INCLUDED

A. Indoor air conditioning units with microprocessor-based controls.

B. Outdoor remote mounted air-cooled condensing units

C. The system shall have a total cooling capacity and a sensible cooling capacity as indicated in the Mechanical Schedules.

D. The unit is to be supplied for operation on a power supply as indicated in the Mechanical Schedules and the Electrical drawings.

1.3 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

C. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

D. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

E. Section 23 07 19 - HVAC Piping Insulation

F. Section 23 23 00 - Refrigerant Piping

G. Section 23 41 00 - Air Filters

H. Section 23 05 93 - Testing, Adjusting, And Balancing

I. Section 23 21 13 - Above Ground Hydronic Piping

J. Section 23 21 19 - Hydronic Specialties

1.4 REFERENCES

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.

C. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.

D. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

E. ISO 9001 - Quality management systems -- Requirements.

F. NFPA 70 - National Electrical Code.

G. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

H. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

I. UL 1995 - Heating and Cooling Equipment.

J. UL 705 - Power Ventilators.

1.5 QUALITY ASSURANCE

A. The unit shall be approved and listed by Underwriters' Laboratories, Inc. Unit performance shall be certified in accordance with AHRI 210/240.

B. The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, "Hi-Pot" Test (two times rated voltage plus 1000 volts, per NRTL agency requirements), and Metering Calibration Tests. The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

C. System shall be supplied with CSA Certification to the harmonized U.S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for "Heating and Cooling Equipment" and marked with the CSA c-us logo (60Hz only).

D. UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705.

E. UL Compliance: Fans and components shall be UL listed and labeled.

F. Nationally Recognized Testing Laboratory Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

G. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

H. Electrical Component Standard: Components and installation shall comply with NFPA 70.

I. Sound Power Level Ratings: Comply with AMCA 301. Test fans in accordance with AMCA 300. Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

J. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA 210.

1.6 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B. Product data for selected models, including specialties, accessories, and the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound power ratings.
3. Motor ratings and electrical characteristics plus motor and fan accessories.
4. Materials, gages and finishes, include color charts.

C. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D. Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

E. Product certificates, signed by manufacturer, certifying that their products comply with specified requirements.

F. Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Materials and Methods".

G. For roof mounted outdoor units provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Equipment shall be stored and handled in accordance with the unit manufacturer’s instructions.

B. Lift and support units with the manufacturer's designated lifting or supporting points.

C. Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

D. Deliver units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units for any purpose, temporary or permanent, until filters are in place, bearings lubricated, refrigeration piping has been tested and charged and fan has been test run under observation.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

1.10 WARRANTY

A. Provide a full parts, labor, and refrigerant warranty by the equipment manufacturer for one year from start-up or 18 months from shipment, whichever occurs first.

B. Provide a full parts warranty by the equipment manufacturer for five years, effective from date of factory start-up and certification.

C. Provide a compressor parts warranty by the equipment manufacturer for seven years, effective from date of factory start-up and certification.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide an indoor wall-mounted, factory assembled, pre-charged, pre-wired, tested and ready to operate air conditioning unit.

2.2 APPROVED MANUFACTURERS

A. Daikin

B. Trane/Mitsubishi

2.3 WALL-MOUNTED INDOOR UNIT

A. GENERAL

1. The unit shall be a wall-mounted style indoor unit with outlet vane and return inlet grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. UNIT CABINET

1. The cabinet shall be formed from high strength molded high impact, non-metallic material with smooth finish, flat front panel design with access for filter. Cabinet color shall be white. The unit shall be wall mounted by means of a factory supplied, pre-drilled, mounting plate.
2. The cabinet shall be designed so all components are easily accessible for service and maintenance through either the front or rear of the unit. Units that are not fully accessible from front and rear or not serviceable in place shall be unacceptable.

C. FAN AND AIR DISTRIBUTION

1. The air distribution system shall be constructed with a quiet, cross flow direct-drive fan assembly. The single fan motor shall be high-efficiency type, equipped with permanently lubricated bearings. The fan shall be capable of a minimum of three speeds for airflow modulation (High, Med, Low) and Sleep. Dehumidification shall utilize the lower fan speed.
2. Unit shall be provided with an integral, motorized, multi-position, air sweep vane to provide uniform, adjustable vertical air distribution. Air sweep vane operation shall be user selectable using the unit controller.
3. Unit shall be provided with a manually adjustable guide vane for horizontal air distribution.

D. FILTER

1. The filter shall be an integral part of the system, located within the cabinet and serviceable from the front. The filters shall be half-inch thick, washable type.

E. COIL

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan.
7. Both refrigerant lines to the indoor units shall be insulated.

F. ELECTRICAL

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be equipped to allow the indoor unit to be powered directly from the associated outdoor unit using 3-wire, 14 gauge AWG connections plus ground.

2.4 4-WAY CEILING-RECESSED CASSETTE WITH GRILLE INDOOR UNIT

A. GENERAL

1. The unit shall be a four-way cassette style indoor unit that recesses into the ceiling with a ceiling grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns for different ceiling heights. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. UNIT CABINET

1. The cabinet shall be space-saving ceiling-recessed cassette. Unit cabinet shall be constructed of zinc-coated steel. Unit air distribution grille shall be constructed of high impact non-metallic material.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
3. Branch ducting shall be allowed from cabinet.
4. Four-way grille shall be fixed to bottom of cabinet allowing two, three or four-way blow.
5. The grille vane angles shall be individually adjustable from the wired remote controller to customize the airflow pattern for the conditioned space

C. FAN

1. The indoor fan shall be an assembly with a turbo fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of five (5) speed settings, Low, Mid1, Mid2, High and Auto.
4. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
5. The indoor unit shall have an adjustable air outlet system offering 4-way airflow, 3-way airflow, or 2-way airflow.
6. The indoor unit shall have switches that can be set to provide optimum airflow based on ceiling height and number of outlets used.
7. The indoor unit vanes shall have 5 fixed positions and a swing feature that shall be capable of automatically swinging the vanes up and down for uniform air distribution.
8. The vanes shall have an Auto-Wave selectable option in the heating mode that shall randomly cycle the vanes up and down to evenly heat the space.
9. The grille shall have an optional sensor that will measure room temperature variations and adjust the airflow accordingly to evenly condition the space.

D. FILTER

1. The filter shall be an integral part of the system, located within the cabinet and serviceable from the bottom. The filters shall be half-inch thick, washable type.

E. COIL

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan.
7. Both refrigerant lines to the indoor units shall be insulated.

F. ELECTRICAL

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be equipped to allow the indoor unit to be powered directly from the associated outdoor unit using 3-wire, 14 gauge AWG connections plus ground.

2.5 CEILING-SUSPENDED INDOOR UNIT

A. GENERAL

1. The unit shall be a one-way ceiling suspended style indoor unit that installs flush to the underside of the ceiling. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns for different ceiling heights. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. UNIT CABINET

1. Unit cabinet shall be constructed of pre-coated steel with white finish. The discharge components shall be coated to prevent condensation. The unit inlet grille shall be constructed of high impact non-metallic material. The inlet grille shall be hinged to allow access to the filters, indoor fan motor, and control box.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.
3. The unit shall include an integral, motorized, multi-position, horizontal air sweep louver at the unit discharge.

C. FAN

1. The indoor fan shall be an assembly of multiple fans direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.
3. The indoor fan shall consist of five (5) speed settings, Low, Mid1, Mid2, High and Auto.
4. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.

5. The motorized horizontal air sweep louver shall provide uniform air distribution up and down from the unit discharge. Five fixed positions and an auto swing feature shall be provided and controllable from the unit controller.

D. FILTER

1. The filter shall be an integral part of the system, located within the cabinet and serviceable from the bottom. The filters shall be half-inch thick, washable type.

E. COIL

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan.
7. Both refrigerant lines to the indoor units shall be insulated.

F. ELECTRICAL

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be equipped to allow the indoor unit to be powered directly from the associated outdoor unit using 3-wire, 14 gauge AWG connections plus ground.

2.6 CEILING-CONCEALED DUCTED INDOOR UNIT

A. GENERAL

1. The unit shall be a ceiling-concealed ducted indoor fan coil design that mounts above the ceiling. The unit shall be rated for installation within ceiling plenums.
2. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. UNIT CABINET

1. The unit cabinet shall be constructed of zinc-coated steel.
2. The cabinet panel shall have provisions for a field installed filtered outside air intake.

C. FAN

1. The unit shall feature external static pressure settings from 0.14 to 0.60 in. WG.
2. The indoor unit fan shall be an assembly with one or two fan(s) direct driven by a single motor.
3. The indoor fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.

4. The indoor fan shall consist of a minimum of three (3) speeds, High, Mid, and Low plus the Auto-Fan function.
5. The indoor unit shall have a ducted air outlet system and ducted return air system.

D. FILTER

1. Return air shall be filtered by means of a standard factory installed return air filter.
2. Return filter box with high-efficiency filter shall be provided for all indoor units. Filter efficiency ratings shall be as scheduled.

E. COIL

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The condensate shall be gravity drained from the fan coil.
7. Both refrigerant lines to the indoor units shall be insulated.

F. ELECTRICAL

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be equipped to allow the indoor unit to be powered directly from the associated outdoor unit using 3-wire, 14 gauge AWG connections plus ground.

2.7 MULTI-POSITION DUCTED INDOOR UNIT

A. GENERAL

1. The unit shall be a vertical or horizontal, multi-position ducted indoor fan coil design that mounts above the ceiling or in a mechanical space. The unit shall be rated for installation within ceiling plenums.
2. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B. UNIT CABINET

1. The unit cabinet shall be constructed of painted, zinc-coated, steel.
2. The unit shall include a fixed return and fixed discharge.

C. FAN

1. The unit fan shall be an assembly with a single, statically and dynamically balanced direct drive fan with a high efficiency DC motor with permanently lubricated bearings.

2. The unit shall have a minimum of three speeds with the selectable capability to operate with external static pressure from 0.3 to 0.80 in. WG.

D. FILTER

1. The unit shall include a filter rack for 1" thick replaceable filter.
2. Filter efficiency ratings shall be as scheduled.

E. COIL

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phos-copper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. The condensate shall be gravity drained from the fan coil.
7. Both refrigerant lines to the indoor units shall be insulated.

F. ELECTRICAL

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
2. The system shall be equipped to allow the indoor unit to be powered directly from the associated outdoor unit using 3-wire, 14 gauge AWG connections plus ground.

G. OPTIONAL AUXILIARY ELECTRIC HEATER

1. The unit shall be provided with a manufacturer supplied electric heat kit accessory. The electric heater shall provide the capacity and number of stages as scheduled. The heater shall be designed to work with the associated indoor unit without requiring modifications to the indoor unit or to the control sequence.
2. The electric heater shall be provided with a dedicated power supply separate from power to the indoor unit.

2.8 MICROPROCESSOR CONTROL

A. The control system shall be microprocessor-based, factory-wired into the system and tested prior to shipment. The wall-mounted control enclosure shall be 4.75" x 4.75" and white in color with include a light-blue LCD providing continuous display of operating status and alarm condition. There shall be a built-in weekly schedule with up to 5 scheduled event settings per day.

B. A 5-key membrane keypad for setpoint/program control, increase/decrease temperature set point, fan speed selection and unit operation mode shall be located below the display. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and Temperature changes shall be by increments of ±3.6°F (±2°C).

C. The control display shall be field-wired to the control board using factory-supplied thermostat wire with plugs. The control voltage from the wired controller to the indoor unit shall be 12 volts, DC. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. Communication cable can be extended to a maximum of 164 feet, between controller and indoor unit.

D. The control shall be able to be programmed for a temperature set point between 64 - 86°F (18 - 30°C) with a sensitivity of ±3.6°F (±2°C).

E. The control system shall prevent compressor short-cycling by a 3-minute timer from compressor stop to the next start.

F. For startup after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed at the wall mounted controller.

G. The control system shall monitor unit operation and activate a visual alarm in the event of an alarm condition.

H. Unit controls shall be capable of interfacing the EMCS via BACnet communication protocol. If BACnet protocol is not a native communication protocol to the factory controls, then a separate gateway shall be provided as required.

2.9 OUTDOOR AIR-COOLED PROP FAN CONDENSING UNIT

A. Condensing unit components shall include a condenser coil, a brush-less digitally controlled variable propeller-type fan, an inverter driven twin rotary compressor, electronic expansion valve, 4-way reversing valve.

B. All components shall be factory-assembled, charged with R-410A refrigerant and sealed. No internal piping, brazing, dehydration or charging shall be required.

C. The condenser coil shall be constructed of copper tubes and aluminum fins.

D. The condensing unit shall be designed to operate at a sound level less than 57 dBA.

E. The casing shall be constructed from galvanized steel plate, finished with a white electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability. Easy access shall be afforded to all serviceable parts by means of removable panel sections. The fan grill shall be constructed of polypropylene.

F. The condensing unit shall be furnished with a single DC fan motor. The fan blade shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.

G. The condensing unit coil shall be of copper tubing with louvered aluminum fins. The coil shall be protected with an integral metal guard. The coil shall have an anti-corrosive coating designed to prevent natural surface corrosion of the aluminum fins, maintaining heat transfer properties of the coil and extending service life. Refrigerant flow from the condenser shall be controlled by means of an electronic expansion valve (EEV) metering device. The EEV shall be controlled by a microprocessor step motor.

H. The compressor shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used. The outdoor unit shall have an accumulator and high-pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

2.10 ACCESSORIES

A. The unit shall be provided with a wind baffle low ambient operation kit. The wind baffle shall be constructed on 20 gauge sheet metal and painted to prevent corrosion. Unit shall be able to provide 100% capacity when operating at 0ºF outdoor air temperature and a wind baffle is used.

B. The unit shall be provided with a cooling coil condensate pump. The condensate pump shall be complete with integral float switch, pump, motor assembly and reservoir.

C. The unit shall be provided with a BACnet gateway for integration with the EMCS.

PART 3 - EXECUTION

3.1 INSTALLATION OF AIR CONDITIONING UNIT

A. General

1. Install air conditioning unit in accordance with manufacturer's installation instructions. Install unit plumb and level, firmly anchored in location indicated, and maintain manufacturer’s recommended clearances.
2. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.
3. Install unit and all field mounted accessories in accordance with NFPA 90A and NFPA 90B.

B. Electrical Wiring

1. Install and connect electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer’s electrical connection diagram submittal to electrical contractor. Install and wire per local and national codes.

C. Piping Connections

1. Install and connect devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's piping connection diagram submittal to piping contractor.

D. Drain Water Piping

1. Connect drain line to air conditioning unit. Unit drain shall be trapped internally.

E. Field-Supplied Pan

1. A field-supplied pan with drain shall be installed beneath cooling units installed above a ceiling and heat pumps.

3.2 FIELD QUALITY CONTROL

A. Startup air conditioning unit in accordance with manufacturer's startup instructions. Test controls and demonstrate compliance with requirements. Provide system start-up services by manufacturer's authorized service representative confirming all system equipment and components have been installed in accordance with the manufacturer's written instructions. Provide formal report for engineer and owner review and approval.

END OF SECTION

SECTION 23 82 19

FAN COIL UNIT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.2 SCOPE

A. Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.3 REFERENCES

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.

B. AHRI 260 (I-P) - Sound Rating of Ducted Air Moving and Conditioning Equipment.

C. AHRI 340/360 (I-P) - Standard for Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.

D. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils.

E. AHRI 430 (I-P) - Performance Rating of Central Station Air-Handling Units.

F. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

G. ASTM B75/B75M - Standard Specification for Seamless Copper Tube.

H. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

J. ICC (IECC) - International Energy Conservation Code.

K. NFPA 70 - National Electrical Code.

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

N. SCAQMD 1168 - Adhesive and Sealant Applications.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

P. UL 1995 - Heating and Cooling Equipment.

1.4 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with mechanical installations similar to that required for this project.

B. All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84, UL 723 and NFPA 90A.

1. Exception: Outdoor mechanical insulation may have a flame spread index of 75 and smoke-developed index of 150.

C. Duct and plenum insulation shall comply with minimum R-value requirements of ICC (IECC) and ASHRAE Std 90.1 I-P unless greater values are indicated otherwise in the contract documents.

D. Adhesive and other material shall comply with NFPA 90A and NFPA 90B. All adhesives and sealants used on interior of building shall comply with VOC limits prescribed by SCAQMD 1168.

E. Unit fan(s) shall comply with the maximum allowable fan motor horsepower per ICC (IECC) and ASHRAE Std 90.1 I-P.

F. Unit shall meet or exceed minimum efficiency ratings in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P per testing standards prescribed by AHRI 210/240 or AHRI 340/360 (I-P).

G. Units shall be tested and certified with AHRI 430 (I-P) and AHRI 260 (I-P).

H. All coils shall be constructed to meet the requirements of AHRI 410.

1.5 WARRANTY

A. Provide entire unit with parts and labor warranty by the equipment manufacturer for one year from start-up or 18 months from date received on site.

B. For units with DX coils, provide all components of the refrigeration circuit with parts and labor warranty by the equipment manufacturer for five years.

1.6 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.

4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. JCI/York

C. Trane

D. Lennox

2.2 GENERAL

A. Fan coil units shall be factory built, manufactured as scheduled on Drawings. Contractor shall field verify exact clearances required for fan coil units. Units shall be field located as required and shop drawings shall indicate final location for approval by Architect/Engineer.

B. Furnish and install fan coil units of the type, capacities, ratings and drive motor horsepower shown on the Drawings.

2.3 CASING

A. Unit casing shall be constructed of minimum 18-gauge galvanized steel, able to withstand a 125 hour salt spray test per ASTM B117. Unit shall have access panels on each side constructed of minimum 18-gauge galvanized steel.

B. Unit casing shall be insulated with single wall, 1 inch thick, foil-faced fiberglass insulation with a minimum rating of R-4 and shall be rated for a maximum air velocity of 5,000 feet per minute.

C. All access panels shall be fully insulated and attached with fasteners. No piping or conduit shall pass through any access panel.

D. All units shall be provided with hanger rod holes in top and bottom panels for suspension installations.

2.4 DRAIN PAN

A. All units shall be provided with one-piece stainless steel drain pan with welded corner construction. Drain pan shall be insulated with closed cell foam insulation.

B. For units installed above an accessible ceiling, provide secondary drain pan. Drain pan shall be galvanized steel and shall slope at a minimum of 1/8” per foot to drain connection. The drain pan shall extend 3” larger on all sides than unit footprint.

2.5 DIRECT EXPANSION COIL

A. Direct expansion coils shall be furnished with a brass distributor with solder type connections, Suction and discharge connections shall be on the same end regardless of row depth. Coils shall have intertwined circuits for equal operation on each circuit. Provide the number of distributors equal to the number of refrigerant circuits to the associated condensing unit. Refrigerant piping connections shall be clearly labeled on outside of unit.

B. Direct expansion coils shall be selected to match the saturated suction temperature and capacity of the associated condensing unit.

C. Maximum face velocity across cooling coil shall be 500 FPM, unless noted otherwise on equipment schedule.

2.6 ELECTRIC HEATING COIL

A. The unit manufacturer shall furnish an electric resistance heating assembly with heating capacity, voltage and stages as scheduled. The heater assembly shall be factory wired and installed with over temperature protection.

B. The heater assembly shall be designed and rated for installation in a blow through configuration.

C. The heater assembly shall be furnished with an incoming power distribution block capable of accepting at least 125% of the calculated current load.

D. The heater assembly shall be listed for zero clearance meeting all NFPA 70 requirements and shall be cETL listed in compliance with UL 1995.

2.7 FAN AND MOTOR ASSEMBLY

A. Units shall be furnished with double inlet, forward curved centrifugal blower that shall be statically and dynamically balanced as an assembly.

B. Fan and motor assembly shall be in a direct drive, draw-through configuration. Belt drive units are not acceptable.

C. Fan motors shall be electronically commutated with thermal overload protection and constant torque operation. The motor shall be programmed in the factory to meet the specified airflow value.

D. Fan motors shall be permanently lubricated and sealed bearings and shall operate on single or three phase power.

E. Fan motors shall be installed, factory programmed and wired to the control panel. Motor wiring shall be terminated in a junction box external to unit casing.

F. Fan motors shall be internally isolated from unit casing.

2.8 FILTERS

A. All units shall be furnished with a flat filter rack with hinged access on both sides designed for a 2” nominal standard sized filter.

B. Factory shall provide one complete set of spare throwaway filters for each unit.

C. Refer to 23 41 00 - Air Filters for additional information.

2.9 MIXING PLENUM

A. Mixing plenum shall be field fabricated and insulated as shown on drawings.

2.10 CONTROLS

A. The unit fan motor shall be completely factory wired to an external electrical enclosure. An external main incoming power non-fused disconnect switch shall be factory furnished and wired by the unit manufacturer for single point power connection.

B. Each unit shall include a 24 VAC control circuit transformer, motor control board, motor circuit fusing and terminal strip for connection of field wiring.

C. The unit shall be factory run tested and end devices shall be factory wired to terminal strip and tested for wiring continuity.

D. Each unit shall include a low voltage fan speed control device.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All HVAC equipment shall be installed as per manufacturer's printed installation instructions.

B. All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer’s requirements.

C. Locations of equipment shown on the drawings are approximate. Locate units so that they may be adequately serviced and maintained.

D. During construction, provide temporary closures of taped polyethylene on openings to prevent construction dust and debris from entering unit.

E. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fans have been test run under observation.

F. Set each unit level and straight.

G. Remove all shipping blocks and restraints.

H. Make condensate drain connection. Verify that drain is properly trapped, vented and sloped to condensate termination location as shown on the drawings.

I. Make duct connections using flexible connectors. Verify that duct is independently and adequately supported.

3.2 MANUFACTURER START-UP SERVICES

A. Provide authorized representative of the manufacturer to inspect the assembly and installation of each unit. No start-up, testing or adjusting may be performed until the representative has determined that the unit has been properly installed.

B. The representative shall start-up, test and adjust units. The representative shall perform operational checks to make certain that all equipment and controls of the systems are operating properly. If defects or improper adjustments are found, they shall be corrected and tested again.

C. The representative shall prepare and provide a written start-up report to include any measurements taken, test results obtained or corrective actions required.

D. If unit has packaged controls, the manufacturer's representative shall attend a separate meeting on-site with the EMCS contractor to coordinate and execute programming between the packaged equipment controls and the EMCS.

END OF SECTION

SECTION 23 82 39

ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electric unit heaters.

1.2 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

C. The scope of the work shall include the furnishing and complete installation of the equipment covered by this section, with all auxiliaries, ready for owner's use.

1.3 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 23 09 63 - Energy Management and Control System (EMCS): Installation of thermostats and other controls components.

B. Section 26 29 26 - Miscellaneous Electrical Controls and Wiring: Installation and wiring of thermostats and other controls components.

1.4 RELATED SECTIONS

A. Section 23 02 00 - Basic Materials and Methods for HVAC

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment

1.5 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

C. UL 1278 - Movable and Wall- or Ceiling-Hung Electric Room Heaters.

D. UL 1995 - Heating and Cooling Equipment.

E. UL 2021 - Fixed and Location Dedicated Electric Room Heaters.

1.6 QUALITY ASSURANCE

A. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL 1995, UL 1278, and UL 2021 as applicable), Intertek (ETL), or other third-party national recognized testing laboratory acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

1.7 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled per unit manufacturer's recommendations.

1.8 SUBMITTALS

A. Submit shop drawings and product data under provisions of Division One.

B. Submit shop drawings indicating components, assembly, dimensions, weights, and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and electronic valves required for complete system.

C. Submit product data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

D. Manufacturer's Installation Instructions: Indicate rigging, assembly, and installation instructions.

1.9 WARRANTY

A. Provide manufacturer's warranty one-year parts and labor warranty.

1.10 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Q-mark

B. Reznor

C. Modine Manufacturing Company

D. TPI Corporation (Markel, Raywall, Redd-i)

2.2 CABINET

A. Construct casing of 18 gage steel and threaded pipe connections for hanger rods.

B. The control enclosure compartment factory installed to the bottom of heater shall be provided with hinged and latched access door that opens from bottom to simplify wiring installation and maintenance.

C. Provide discharge louvers which are adjustable in both horizontal and vertical directions. Provide baked enamel finish to louvers.

2.3 FAN

A. Manufacture fan blades from anodized aluminum.

B. Provide quiet, propeller-blade fan, connected directly to drive motor.

C. Statically and dynamically balanced fans and equip with substantial fan guard.

D. Horizontal models with permanently lubricated sleeve bearings.

E. Vertical models with grease lubricated ball bearings.

2.4 MOTOR

A. Motors shall be totally enclosed, permanently lubricated, and thermally protected.

B. Motor shall be factory wired to control enclosure compartment.

C. Both motor and fan blade shall be factory installed within heater casing on rubber isolators to minimize vibration and noise.

2.5 ELECTRIC HEATING ELEMENTS

A. Element shall consist of a nickel-chromium resistance wire surrounded with magnesium oxide and sheathed in steel spiral-finned tubes.

B. Elements shall have kilowatt rating as scheduled in drawings.

2.6 THERMAL OVERLOAD PROTECTION

A. Equip heaters with auto reset thermal overloads that are sealed to prevent moisture to enclosure.

B. Thermal overload protection shall shut down element and motor if safe operating temperatures are exceeded.

2.7 CONTROLS

A. Provide heaters with 24-volt transformer and control circuit, NEC required fusing, power-on indicator, thermostat with stainless steel capillary sensor and three position switch factory-installed and wired in the control enclosure compartment to the terminal block for ease of wiring.

B. Thermostat shall be field adjustable from 40 to 70°F.

2.8 MOUNTING HARDWARE

A. Provide with universal mounting bracket and all necessary accessory hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that space is ready for installation of units as indicated on shop drawings.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install unit heaters in accordance with manufacturer's instructions.

B. Install unit heaters in accordance with NFPA 70 and NFPA 90B.

END OF SECTION

SECTION 26 02 00

BASIC MATERIALS AND METHODS FOR ELECTRICAL

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Electrical items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies within the Contract Documents discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning electrical system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. Contractor shall participate in the commissioning process; including but not limited to meeting attendance, completion of checklists and participation in functional testing.

1.3 RELATED SECTIONS

A. General Conditions

B. Supplementary Conditions

C. Division One

1.4 COOPERATION WITH TRADES

A. Cooperation with trades of adjacent, related, or affected materials or operations shall be considered a part of this work in order to affect timely and accurate placing of work and bring together in proper and correct sequence, the work of such trades.

1.5 REFERENCES

A. National Electrical Code (NEC)

B. American Society for Testing and Materials (ASTM)

C. Underwriter's Laboratories, Inc. (UL)

D. Insulated Cable Engineer's Association (ICEA).

E. National Electrical Manufacturer's Association (NEMA).

F. Institute of Electrical and Electronic's Engineers (IEEE).

G. American National Standards Institute (ANSI).

H. National Fire Protection Association (NFPA).

I. International Energy Conservation Code (IECC).

1.6 COMPLETE FUNCTIONING OF WORK

A. All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B. Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.

1. Approximate location of transformers, feeders, branch circuits, outlets, lighting and power panels, outlets for special systems, etc., are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such outlets, conduit runs, etc., and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.
2. Communicate with the Architect and secure his approval of any outlet (light fixture, receptacle, switch, etc.) location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific approval, shall be removed and relocated when so directed by the Architect. Location of light fixtures shall be coordinated with reflected ceiling plans.

C. Additional coordination with mechanical contractor may be required to allow adequate clearances of mechanical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.7 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.8 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:

1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.

3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. Onsite supervision, journeyman shall have minimum of journeyman license. Helpers, apprentices shall have minimum of apprentice license.

1.9 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.10 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 1993 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C. Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.12 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.
7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.

9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 1 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.

6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Furnish detailed shop drawings, descriptive literature, table of contents listing all items being submitted at the beginning of each submittal package, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:

1. Distribution Panelboards
2. Panelboards
3. Wiring Gutters
4. Heavy Duty Disconnect Switches
5. Lighting Fixtures
6. Lighting Contactors
7. Time Clocks
8. Lighting Control System
9. Photocells
10. Wiring Devices and Plates
11. Conduit and Fittings
12. Wire
13. Emergency Generator
14. Automatic Transfer Switches
15. Fire Alarm System
16. Surge Protection Devices (SPD)
17. Lightning Protection

I. Refer to each specification section for additional requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
   a. Wall and type locations.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
   e. Equipment connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Routing of storm and sanitary sewer piping.
   h. Fire-rated wall and floor penetrations.
   i. Sizes and location of required concrete pads and bases.
   j. Valve stem movement.
   k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DRAWINGS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 26.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

E. If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

F. The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____

(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 26.

1.17 MAINTENANCE MANUALS

A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in “D ring type” binders by National model no. 79-883 or equal, binders shall be large enough to allow 1/4” of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and ed for easy reference and shall utilize the individual specification section numbers shown in the Electrical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 26 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 26, include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Fault Current calculations and Coordination Study.
3. Reviewed shop drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
8. Equipment name plate data.
9. Wiring diagrams.
10. Exploded parts views and parts lists for all equipment and devices.
11. Color coding charts for all painted equipment and conduit.
12. Location and listing of all spare parts and special keys and tools furnished to the Owner.
13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 26 Sections for additional Operator Training requirements.

1.19 SITE VISITATION

A. Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C. Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

D. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.20 WARRANTY

A. The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

B. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, freight/shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service call required to diagnose warranty problems.

1.21 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner’s risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney’s fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data’s creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be Contractor’s sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect’s written consent.

1. It is agreed that “MEP” hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

2. If the client, Architect or Owner of the project requires electronic media for “record purposes”, then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD’s. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
3. At the Architect/Owner’s request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a “.rvt” or “.dwg” format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:

1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.
2. Alternate equipment must be equal from the standpoint of materials, construction and performance.
3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B. The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.2 PRODUCT LISTING

A. Products used on this project shall be listed by Underwriters' Laboratories.

2.3 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:

1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.4 EQUIPMENT PADS

A. Provide 4-inch-high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum of 6 inch beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

B. Provide 6-inch-high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum of 6 inch beyond the equipment. Provide a 4-foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

C. Provide a minimum 6-inch-high, steel reinforced concrete pad for generators. Pads shall be sized 6” larger that the outside perimeter dimensions. Provide a 4-foot monolithic extension to the pad around the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.). Refer to structural details. Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise. The generator shall be bolted to the concrete pad per the manufacturers details.

D. Provide steel reinforced concrete pad for utility transformers. Pads shall comply with Utility Company Standards.

2.5 ESCUTCHEONS

A. Provide heavy chrome or nickel plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.6 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.7 PAINTING

A. All factory assembled equipment for electrical work, except light fixtures, that normally is delivered with a factory applied finish shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

2.8 ELECTRICAL SYSTEM IDENTIFICATION

A. Conduit Systems: Provide adequate marking of major conduit which is exposed or concealed in accessible spaces to distinguish each run as either a power or signal/communication conduit. Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Indicate voltage for that raceway. Locate markers at ends of conduit runs, on pull boxes, on junction boxes, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors, or enters non-accessible construction and at spacings of not more than 50 feet along each run of conduit. Switch-leg conduit and short branches for power connections do not have to be marked, except where conduit is larger than ¾ inch. Branch circuit conduits, junction boxes and pull boxes shall be marked with a permanent marker indicating panel name and branch circuit numbers.

B. Underground Cable Identification: Bury a continuous, preprinted, bright colored plastic ribbon cable marker with each underground cable (or group of cables), regardless of whether conductors are in conduit, duct bank, or direct buried. Locate each directly over cables, 6 to 8 inches below finished grade.

C. Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way. Provide black back plate with white letters and numbers for normal equipment. Provide red back plate with white letters and numbers for optional emergency equipment. Provide yellow back plate with white letters and numbers for Life safety equipment.
2. A black-white-black laminated plastic engraved identifying nameplate shall be secured by stainless steel screws to each automatic transfer switch, switchboard, distribution panel, motor control center, motor starter panels and panelboards.
   a. Identifying nameplates shall have ¼ inch high engraved letters and shall contain the following information:
      1) Name
      2) Voltage
      3) Phase
      4) "3" or "4" wire, and
      5) Where it is fed from.
   b. An example of a panelboard nameplate is:

Center Panel – 1A
208/120 volt, 3 phase, 4 wire
Center Fed from MDP

c. An example of an automatic transfer switch nameplate is:
Center ATS
208/120 volt, 3 phase, 4 wire, 4 pole
Center Fed from MDP

3. Each feeder device in a switchboard, distribution panel, and motor control center device shall have a nameplate showing the load served in ½ inch high engraved letters.
4. A black-white-black laminated plastic engraved identifying nameplate shall be secured by screws to each transformer, safety switch, disconnect switch, individual motor starter, enclosed circuit breaker, wireway, and terminal cabinet.
   a. Identifying nameplates shall have 1/4 inch high engraved letters and shall indicate the equipment served.
   b. An example of a disconnect switch is: ACCU-1.
5. Prohibited Markings: Markings which are intended to identify the manufacturer, vendor, or other source from which the material has been obtained are prohibited for installation within public, tenant, or common areas within the project. Also, prohibited are materials or devices which bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters' Laboratories, Inc.), and approval labels are exceptions to this requirement.
6. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.
7. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical system, provide tags of plasticized card stock, either preprinted or hand printed. Tags shall convey the message, example: "DO NOT OPEN THIS SWITCH WHEN BURNER IS OPERATING."

PART 3 - EXECUTION

3.1 EXCAVATING AND BACKFILLING

A. Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3" of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. All work shall comply with OSHA Standards.

3.2 WORKMANSHIP AND CONCEALMENT

A. The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of electrical work shall be concealed in walls, chases, under floors and above ceilings except:

1. Where shown to be exposed.
2. Where exposure is necessary to the proper function.

3.3 SLEEVES, CUTTING AND PATCHING

A. This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O-Z/Gedney.

B. All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

C. All un-used sleeves shall be sealed with 2 hour UL approved fire sealant manufactured by "3M" or approved equal.

D. Refer to 26 05 33 for additional requirements.

3.4 ELECTRICAL GEAR

A. Install all electrical equipment in accordance with the National Electrical Code and as shown on the drawings.

B. Lighting contactors, time clocks, fire alarm equipment, security equipment disconnect switches, etc. mounted in mechanical/electrical rooms shall be mounted at a working height not requiring a ladder, when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices (note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

C. Fire retardant back boards secured to drywall studs may be used for contactors, time clocks, fire alarm equipment, security equipment, and disconnect switches 60 amp or smaller. All other wall mounted devices shall be mounted to unistrut. Unistrut shall be securely mounted to the floor and structural ceiling. Toggle bolts or anchor bolts attached to drywall is not acceptable.

3.5 CLEANING

A. Clean lighting fixtures and equipment.

B. Touch-up and refinish scratches and marred surfaces on panels, switches, starters, and transformers.

3.6 CORROSIVE AREAS

A. In areas of a corrosive nature, which include but are not limited to the following: pool equipment rooms, cooling towers and areas subject to salt air, etc., provide NEMA 4 X stainless steel or fiberglass reinforced enclosures for contactors, panel boards, controllers, starters, disconnects and materials used as supporting means (i.e. plastibond unistrut, pipe, fittings). The use of spray on coating may be acceptable in some applications.

3.7 TESTS AND INSPECTIONS

A. Tests and inspection requirements shall be coordinated with Division I.

B. Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C. Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D. Put circuits and equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E. Final Inspection:

1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.
2. Panelboards, switches, fixtures, etc., shall be cleaned and in operating condition.
3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.
4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.
5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

F. The contractor shall provide a thermographic test using an independent testing laboratory using an infrared scanning device. This test shall include but not limited to all switchboards, distribution panelboards, panelboards, automatic transfer switches and other electrical distribution devices. This test shall be conducted to locate high temperature levels. This test shall be conducted between 3 to 8 months after occupancy, but not beyond the one year warranty period. Submit test to the architect and engineer using test reporting forms. All unacceptable conditions shall be corrected prior to the end of the warranty period.

END OF SECTION

SECTION 26 05 19

WIRE, CABLE AND RELATED MATERIALS

PART 1 - GENERAL

1.1 SCOPE

A. Provide 600 volt building wire, cable and connectors and 300 volt wire, cable and connectors.

B. WORK INCLUDED: Include the following Work in addition to items normally part of this Section.

1. Wiring for lighting, dimming controls and power.
2. Automatic Control Wiring.
3. Connection of equipment shown.
4. Fire Alarm System.
5. Voice Communications and Sound System.
6. Mineral Insulated Cable (MI)

C. WORK SPECIFIED ELSEWHERE:

1. Heating, ventilating, and air conditioning equipment.
2. Structured cabling system.
3. Coaxial cables

1.2 REFERENCE STANDARDS

A. UL 83 - Thermoplastic-Insulated Wires and Cables

B. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire

C. NFPA 70 - National Electrical Code

D. All wire cable and connectors shall be UL approved.

E. NEMA

F. NEMA Bulletin 119

1.3 ACCEPTABLE MANUFACTURERS

A. 600 VOLT WIRE AND CABLE

1. Southwire
2. Encore
3. Cerro

B. 300 VOLT WIRE AND CABLE

1. Westpenn
2. Beldon
3. Alpha
4. Tappan - Southwire

C. FLEXIBLE CABLE SYSTEMS

1. AFC Modular Cable Systems
2. Kaf-Tech

D. CONNECTORS

1. Ilsco
2. Cooper
3. AMP - TYCO
4. Burndy
5. Ideal
6. 3M
7. O.Z. Gedney
8. Thomas & Betts
9. Buchanan

1.4 SUBMITTALS

A. Shop drawings shall include, but not limited to:

1. Cutsheets of wire, cable and connectors to indicate the performance, fabrication procedures, product variations, and accessories.

1.5 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A. National Electrical Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 WIRING

A. All wire shall be new and continuous without weld, splice, or joints throughout its length. It must be uniform in cross-section, free from flaws, scales and other imperfections.

B. WIRE MATERIAL: Conductors shall be soft drawn, annealed copper. Aluminum wiring is not acceptable unless otherwise noted on drawings.

C. TYPES:

1. Provide type “THHN/THWN-2” insulation for all buried feeders and service entrance conductors.
2. Provide type “THHN/THWN-2” insulation for all branch circuits and above grade feeders.

3. All wire No. 8 and larger shall be stranded. All wire No. 10 and smaller shall be stranded or solid.
4. Provide type "XHHW" or other 90 degrees insulation wiring for branch circuit wiring installed through continuous rows of fixture bodies.
5. All 300-volt cable including but not limited to telephone, fire alarm, data, CATV and security shall be UL listed for use in return air plenums.
6. All dimming conductors shall be 300 volt, 75 C plenum rated. Dimming conductors shall be solid. Stranded conductors are not acceptable.

D. CONDUCTOR SIZES

1. Feeder conductors shall be sized for a maximum of 2% drop in rated voltage at scheduled load.
2. Branch circuit conductors shall be sized for a maximum 3% drop in the rated voltage to the longest outlet on the circuit.
3. Minimum wire shall be 12 AWG, unless otherwise shown on Drawings or required by Code.
4. Minimum wire size for 0-10v dimming controls shall be 18 AWG for conductors not exceeding 300 feet circuit length (one-way) and 16 AWG for those exceeding 300 feet (one-way).

E. COLOR CODING: No. 6 or larger shall use tape for color coding. No. 8 and smaller wire shall be color coded in accordance with the governing authority requirements or as follows:

120/208 Volt
Neutral: White
Phase A: Black
Phase B: Red
Phase C: Blue
Ground: Green
0-10 Volt dimming conductors
Purple (source)
Pink (common)

2.2 GROUNDING

A. Permanently connect all conduit work, motors, starters, and other electrical equipment to grounding system in accordance with NFPA 70.

PART 3 - EXECUTION

3.1 WIRE

A. Do not pull wire into conduit until Work of an injurious nature is completed. Where two or more circuits run to a single outlet box, each circuit shall be properly tagged. Wyreze or approved equal may be used as a lubricant where necessary.

B. Splices shall be fully made up in outlet boxes with compression crimp-on type splice connectors.

C. Joints and splices will not be permitted in service entrance or in feeders. Joints in branch circuits will be permitted where branch circuits divide, and then shall consist of one through-circuit to which the branch shall be spliced. Joints shall not be left for the fixture hanger to make. Connect joints and splices with Buchanan Series "2000" solderless connectors complete with insulating caps or properly sized twist on wire nuts. “Wago” push-in connectors are not acceptable.

D. All stranded conductors shall be furnished with lugs or connectors.

E. Connectors furnished with circuit breakers or switches shall be suitable for copper wire termination.

F. “Sta-Cons” shall be used to terminate stranded conductors on all switches and receptacles.

G. All stranded #10 and small conductors shall be terminated with an approved solderless terminal if the device or light fixture does not have provisions for clamp type securing of the conductor.

H. The jacket for all travelers used on 3-way and 4-way switches shall be pink.

I. Emergency circuits shall not be routed with normal conductors.

3.2 BALANCING SYSTEM

A. The load on each distribution and lighting panel shall be balanced to within 10% by proper arrangement of branch circuits on the different phase legs. Provide written documentation showing results. Submit with O & M manuals.

3.3 LOW VOLTAGE WIRING

A. Low voltage wiring, including dimming conductors, shall be plenum rated. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

B. Low voltage wiring shall be routed in separate raceways from power wiring systems.

C. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

D. Provide Caddy J-hooks supported independently from other system to support cable at 4-foot on center or closer if required by manufacturer.

E. Provide a junction box to make up all joints and splices.

F. Provide dimming conductors for all lighting circuits located in spaces with dimmer switches and theatrical lighting as indicated on the drawings and as specified.

3.4 CABLE SUPPORTS

A. Provide cable supports in all vertical raceways in accordance with Article 300-19 of NFPA 70.

3.5 DEFECTS

A. Defects shall include, but are not to limited to, the following:

1. Tripping circuit breakers under normal operation.
2. Improperly connected equipment.
3. Damaged, torn, or skinned insulation.

END OF SECTION

SECTION 26 05 26

GROUNDING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. WORK COMBINED WITH OTHER SECTIONS: Combine the work specified herein with the following Sections to form a single responsibility for the Work:

1. Electrical.
2. Basic materials and methods.

B. Provide electrical service, equipment and wiring device grounding as shown, scheduled and as specified.

C. The types of grounding include, but not limited to, the grounding bonding of all equipment devices, building steel piping, and as required by the National Electrical Code, Local Inspection Department and Power Company.

1.3 STANDARDS

A. National Electrical Code (NFPA-70)

B. Local municipal and State codes that have jurisdiction.

C. NECA

1.4 ACCEPTABLE MANUFACTURES

A. Provide grounding products manufactured by Copperweld and Cadweld.

1.5 SUBMITTALS

A. Shop drawings shall include, but not limited to the following:

1. Cut sheets of ground rods, clamps and connectors.
2. Grounding system diagram.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide all materials required to construct a complete grounded electrical system.

B. GROUND RODS: Ground rods shall be 3/4" inch diameter by 10 feet long construction with copper jacket and a steel core.

C. CLAMPS: Ground clamps shall be copper except for steel or iron pipes in which the clamps shall be galvanized iron.

D. CONDUCTORS: Conductors shall be connected by means of an approved pressure connector or clamp.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL: Install grounding system as shown and specified to ensure a properly grounded system.

B. SERVICE ENTRANCE GROUNDING SYSTEM: Provide a main bonding jumper between the neutral and ground bus of main distribution panel. Route a separate grounding electrode conductor in conduit from each main gutter to the ground rod grid, incoming cold water piping system, and to the "lightning protection system" (250 - 106 of NEC) under ground bonding loop. Provide a bonding jumper around water meter. The grounding electrode conductor shall be stranded copper, 98% conductivity and shall be run continuous without splices or joints and installed at least 12" below grade.

C. BUILDING STEEL AND PIPING SYSTEM: Install a bonding jumper between building steel and metallic piping systems to bond them to the electrical grounding system.

D. NEUTRAL: The neutral shall be grounded only at the service entrance and other separately derived systems. The neutral shall be kept separate from the grounding system and shall not be used as a ground.

E. GROUNDING SEPARATELY DERIVED ALTERNATING CURRENT SYSTEM

1. STANDBY EMERGENCY GENERATOR: The generator neutral shall be bonded to the generator when a 4-pole switched neutral automatic transfer switch is specified.

F. GROUNDING CONDUCTOR: A grounding conductor and metallic conduit system shall bond all equipment served by the electrical system. Provide a flexible bonding jumper for isolated metallic piping and ductwork and around expansion fittings and joints.

G. CONDUIT GROUNDING BUSHING: Conduit terminating in equipment that has a ground bus such as switchboards, panelboards, etc., shall have grounding bushings installed. Ground each conduit by means of a grounding bushing and to the ground bus in the equipment.

H. MOTORS: The frame of all motors shall be grounded.

I. SPECIAL GROUNDING: Provide a #6 AWG copper grounding conductor for each telephone board, television system, etc. Terminate the grounding conductor on ground bus and to the building electrical grounding system. Refer to 800-40(d) and 820-40(d) of the NEC.

J. REMOTE PANELBOARDS: Provide a grounding electrode conductor all remote panels as required by the NEC and shown on drawings.

K. LIGHTING FIXTURES: Flexible fixture whips containing a green grounding conductor shall be used to connect light fixtures. Flexible fixture whips shall not exceed ten feet.

L. RECEPTACLES: All receptacles shall be grounded using the branch circuit grounding conductor. Receptacles shall use an approved grounding yoke.

3.2 TESTING

A. Perform a ground resistance test using a biddle analog or digital portable earth/ground resistance tester. The system resistance shall not exceed 5 Ohms. Provide additional electrodes as required (refer to 250-84 and 250-56 of the most current edition NEC). Test shall not be conducted following wet weather. Provide personal instruments to conduct these tests and submit certified test for review. Test shall be verified by Engineer.

END OF SECTION

SECTION 26 05 33

RACEWAYS

PART 1 - GENERAL

1.1 SCOPE

A. Provide electrical raceways and fittings as shown, scheduled and specified.

B. The types of raceways and fittings required are as follows:

1. Rigid hot-dipped galvanized steel conduit (GRC) (RMC)
2. Intermediate hot-dipped galvanized steel conduit (IMC)
3. Electrical metallic tubing (EMT)
4. PVC (Sch. 40 & 80)
5. Flexible metal conduit (FMC)
6. Liquid-tight flexible metal conduit (LFMC)
7. PVC coated rigid galvanized steel conduit (GRCC)

REFERENCE STANDARDS

C. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC).

D. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S).

E. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A).

F. NFPA 70 - National Electrical Code.

G. UL 6 - Electrical Rigid Metal Conduit-Steel.

H. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel.

I. UL 360 - Liquid-Tight Flexible Metal Conduit.

J. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.

K. UL 1242 - Electrical Intermediate Metal Conduit-Steel.

L. NEMA FB-1

M. NEMA TC3

1.2 ACCEPTABLE MANUFACTURERS

A. Raceways

1. Allied
2. Republic
3. Prime Conduit (Carlon)
4. Wheatland Tube
5. Cantex
6. Western Tube
7. Robroy Industries

B. Fittings

1. Appleton
2. Crouse Hinds
3. Steel City
4. O.Z. Gedney
5. Carlon
6. Raco, Inc.
7. Bridgeport

C. Boxes

1. RACO
2. Thomas and Betts
3. EATON
4. Crouse-Hinds
5. Appleton

D. Surface

1. Hubbell
2. Wiremold

1.3 SUBMITTALS

A. Product data shall include but not be limited to:

1. Cutsheets for raceways, fitting, solvents, primers, etc.

1.4 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH

A. NFPA 70

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 CONDUIT AND FITTINGS

A. Rigid Galvanized Steel Conduit (GRC/RMC)

1. Construction, Materials, Codes, Standards:
   a. Article 344 - NFPA 70.

b. Hot-dip galvanized rigid steel conduit, galvanized after fabrication. Products shall comply with UL 6 and ANSI C80.1. All threads shall be galvanized after cutting. A uniform zinc coating shall be applied to the inner and outer walls.
c. Fittings shall be threaded and shipped with thread protectors. Set Screw are not acceptable. Die Cast Fittings are not acceptable.

2. Permitted for use in the following locations:
   a. Outdoor or Exterior (Exposed)
   b. Indoors, Conditioned Spaces
   c. Unconditioned Spaces
   d. Underslab (Void Form Slab): where not in contact with earth – only permitted where indicated on plan.
   e. Underslab (Suspended Slab): Permitted – only where indicated on plan.
3. Prohibited Locations: Underground, Corrosive environments, Underslab (Slab on Grade), Foundation penetrations.
4. Specific Uses: Exposed Exterior installations, where within or attached to masonry or concrete, where subject to damage.

B. Intermediate Metal Conduit (IMC)

1. Construction, Materials, Codes, Standards:
   a. Article 342 - NFPA 70.
   b. Conduit shall be similar to rigid steel conduit except thinner wall.
   c. Fittings shall be threaded hot-dipped galvanized and shipped with thread protectors. Set Screw or Die Cast Fittings are not acceptable
   d. Products shall comply with UL 1242.
2. Permitted for use in the following locations:
   a. Outdoor or Exterior (Exposed)
   b. Indoors, Conditioned Spaces
   c. Unconditioned Spaces
   d. Underslab (Void Form Slab): not in contact with earth only as indicated on plan.
   e. Underslab (Suspended Slab): only where indicated on plan.
3. Prohibited Locations: Corrosive Environment, Underground, Underslab (Slab on Grade), Foundation Penetrations
4. Specific Uses: Exposed exterior locations, Rooftops exposed to sunlight

C. Electrical Metallic Tubing (EMT)

1. Construction, Materials, Codes, Standards:
   a. Article 358 - NFPA 70.
   b. EMT shall be made of hot-dip galvanized strip steel. The interior shall be coated with a corrosion-resistant lubricant for ease of wiring pulling.
   c. Shall utilize steel insulated throat, set-screw connectors and steel set-screw couplings in all indoor conditioned spaces.
   d. Shall utilize steel insulated throat, threadless, watertight compression type connectors and steel threadless watertight compression type coupling in all non-conditioned spaces and in grout filled CMU walls.
   e. Products shall comply with UL 797 and ANSI C80.3.
2. Permitted for use in the following locations:
   a. Indoors, Conditioned Spaces

b. Unconditioned Spaces

3. Prohibited Locations: Corrosive Environment, Underground, Underslab (all types), Wet or Damp Locations, Exteriors, Within Concrete, foundation penetrations.
4. Specific Uses: Primary use conduit for indoor spaces, where conditioned. Unconditioned locations shall require use of insulated throat water tight fittings.

D. Rigid Nonmetallic Conduit (PVC Schedule 40 & 80)

1. Construction, Materials, Codes, Standards:
   a. Article 352 and 300.6 - NFPA 70.
   b. Conduit shall be schedule 40 or 80 polyvinyl chloride (PVC), UV stabilized, rated for 90°C conductors.
   c. Fittings shall be solvent weld socket type.
   d. Products shall comply with UL 651.
2. Permitted for use in the following locations:
   a. Underground (Earth, outside foundation perimeter)
   b. Underslab (Slab on Grade): only where indicated on plan.
   c. Under Driveways, roadways, or vehicular crossings, and where required by Utility Company: PVC Schedule 80
      1) PVC Schedule 40 allowed where concrete encased.
3. Prohibited Locations: return air Plenums, interstitial spaces, Outdoor or Exterior (Exposed), Unconditioned spaces, corrosive environments, underslab (suspended or void form), foundation penetrations.
4. Specific Uses: For use underground or underslab (Slab on grade). Underground use is approved for all locations where transiting a project site, not underneath any foundation. For locations under the footprint of building/foundation, use only authorized where indicated on drawings.

E. Flexible Metal Conduit (FMC/Greenfield)

1. Construction, Materials, Codes, Standards:
   a. Article 348 - NFPA 70.
   b. Spirally wound continuously interlocked zinc coated strip steel.
   c. Fittings shall be one screw for smaller than 1-1/2-inch, two screw for 1-1/2-inch and larger, double clamp steel or malleable iron, either cadmium plated or hot-dip galvanized.
   d. Products shall comply with UL 360.
2. Permitted for use in the following locations:
   a. Indoors, Conditioned Spaces.
3. Prohibited Locations: outdoors/Exterior, unconditioned spaces, Corrosive, Wet, Concrete, underslab(all types), underground, foundation penetrations.
4. Specific Uses and Applications: For use in connection to rotating equipment within conditioned spaces, including plenums. Also permitted for use with empty raceways in walls for use with Low Voltage, AV, telecom cabling.

F. Liquid-Tight Flexible Steel Conduit (LFMC/Seal Tite)

1. Construction, Materials, Codes, Standards
   a. Article 350 - NFPA 70.

b. Spirally wound continuously interlocked zinc coated strip steel with a UV stabilized polyvinyl chloride (PVC) outer jacket bonded to the conduit.
c. Fittings shall be compression type, malleable iron, with insulated throat, either cadmium plated or hot-dip galvanized. Plastic is not acceptable.

2. Permitted for use in the following locations:
a. Outdoor or Exterior (Exposed)
b. Indoors, Conditioned Spaces
c. Unconditioned Spaces
3. Prohibited Locations: Concrete, corrosive, underground, underslab (all types), foundation penetrations.
4. Specific Uses and Applications: Primary use is connection to rotating equipment at unconditioned spaces. Transformer Primaries and Secondaries (excluding service transformer).

G. PVC Coated Rigid Galvanized Steel Conduit (GRCC/Plastibond)

1. Construction, Materials, Codes, Standards:
a. Article 344 and 300.6 - NFPA 70.
b. Conduit shall be same as rigid metal conduit with a factory-applied 40-mil-thick covering of polyvinyl chloride (PVC) bonded to the metal, coated inside and outside.
2. Permitted for use in the following locations:
a. Outdoor or Exterior (Exposed): except for stub-ups and penetrations.
b. Corrosive Environment: required throughout
1) Where corrosive environments exist, such as pools, pool pump room, corrosive chemical storage, GRCC shall be provided throughout, up to the point of sealed penetration into a non-corrosive environment.
c. Underground (Earth, outside foundation perimeter): Required at bends of 15° or greater, Penetrations through concrete, Stub-ups through foundation or grade at concrete.
d. Foundation Penetrations
3. Prohibited Locations: extended runs exposed to sunlight, Plenums, Underslab except for penetrations (all foundation types).
4. Specific Uses: For use at Cooling Towers, Pools, Pool Decks, Pool pump rooms, chemical storage, corrosive environments.

2.2 PULL BOXES

A. Exterior in-ground pull boxes shall be concrete or polymer as manufactured by Brooks, Dalworth, Hubbell Quazite, or approved equivalent. Covers shall include identification of systems contained.

B. Where located in Roadways, Parking Lots, or Traffic zones, Pullboxes shall be rated to accept a minimum 25,000 lb. load.

C. All Pullboxes shall be sized based on NEC wire-bending requirements at each individual location.

D. Covers shall include identification of systems contained, such as:

1. Electrical
2. Telecom
3. Communications
4. Others, as required.

E. Pull boxes in pole bases shall be as manufactured by Carlon.

F. Pullboxes shall be provided in all raceway systems upon exceeding the following conditions:

1. The equivalent of 270° in conduit bends, or after (3) 90° bends.
2. Any 400ft of linear conduit or duct bank continuous segments.
3. Where required to make transitions to prevent the damaging of conductor insulation.

2.3 WIREWAYS

A. Wireways shall be made of not less than 16-gauge sheet steel for 4 inch and 6 inch square sizes and 14 gauge steel for 8 inch and 12 inch square sizes. Couplings end plates, and knockouts shall be furnished as required. Each section of wireways shall be rigidly supported.

B. The finish shall be ANSI-49 gray epoxy paint applied by a cathodic electrode position paint process over a corrosion resistant phosphate preparation for NEMA 1 wireways. Provide galvanized steel for NEMA 3R wireways. NEMA 3R wireways and auxiliary gutters are for horizontal mounting only.

2.4 BUSHINGS

A. Provide nylon bushing on end of all low voltage cabling system conduits (sleeves, rough-ins, etc.).

B. Provide Grounding Bushing as required in 26 05 26 - Grounding.

PART 3 - EXECUTION

3.1 PROVIDE CONDUIT AS FOLLOWS:

A. GENERAL: The Drawings are diagrammatic and are intended to show the general location of outlets, devices, fixtures, and arrangement and control of circuits. The Contractor shall determine exact locations by actual measurement of the building or by reference to the Architectural Drawings.

B. Raceways shall not be routed below or within slab-on-grade, foundations, or below grade of suspended slab structures, unless specifically noted or indicated otherwise on plan.

C. EMT in sizes up to 4 inches when concealed or not exposed to damage and located indoors only. (EMT is not acceptable in wet and damp location.)

D. MINIMUM SIZE: 3/4 inch.

E. Flexible conduit of any type shall not be used except for connections to rotating or vibrating equipment, or where use for low voltage raceways. All conduit shall be provided as a rigid type conduit for homeruns, runs between termination boxes, outlets, etc.

F. Fixture whips: Refer to 26 51 19 for additional information.

G. Of such size, and so installed that conductors may be drawn in without injury or excessive strain.

H. Where entering panels, pull boxes, junction boxes, or outlet boxes, shall be secured in place with lock nuts inside and outside, and insulated bushings inside.

I. Have Red seal type VCC or approved equal cable supports in risers, as required by NFPA 70.

J. Have ends reamed after cutting and application of die.

K. Keep conduit corked and dry during construction and swab out before conductors are pulled.

L. Have bends and offsets made with approved tools. Bends or offsets in which the pipe is crushed or deformed shall not be installed.

M. Have O.Z. Gedney or approved equal expansion fittings where crossing building expansion joints.

N. Fixtures in finished areas having suspended acoustical ceilings shall be connected to outlet boxes of lighting grid by flexible metal conduit; length not to exceed ten feet (six feet if using 3/8" manufactured fixture "whips").

O. Outlet boxes in partitions shall never be set back-to-back. They shall be offset to prevent undue noise transmission from room to room.

P. Each entire conduit system shall be installed complete before any conductors are drawn in. Every run of conduit shall be finished before covering up to guard against obstructions and omissions.

Q. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of conduits. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel with a minimum thickness of 1.07MM and set to extend 4" above slab.

R. All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty. All fire rating material shall be installed in accordance with manufacturer`s printed instructions.

S. All conduit shall be cleaned and swabbed to remove all foreign matter and moisture prior to pulling wire and cable. All boxes in which conduits terminate shall be cleaned of all concrete mortar and other foreign matter.

T. Provide #30 nylon pulling line in all conduits in which permanent wiring is not installed.

U. All conduit shall be securely fastened and supported using hot galvanized malleable iron one-hole pipe straps, clamps, hanger or other means approved by the engineer. Supports shall be as required per NEC. Tie wire shall not be used as support or securing means. Support conduit independently of ceiling hanger wire. Use all thread rods to support outlet boxes, junction boxes and conduit.

V. Contact the Architect and Engineer for an installation review before covering any below grade or above grade conduit.

W. All new outlets shall be flush mounted. In remodeled areas where wall construction prohibits flush mounting, provide Hubbell 2400 series, unless noted otherwise. Verify exact location and routing with architect before installation.

X. Contractor shall not penetrate waterproof barriers without using proper fitting to maintain barriers. This shall include exterior walls and slabs. Coordinate with Architect for proper methods.

3.2 CONDUIT ROUTING

A. Conduit shall be concealed and by using the shortest practicable route between outlets, including where located on CMU walls.

B. Conduit may be exposed in electrical and mechanical rooms, and central plants, or other industrial type facilities such as warehouses or production plants.

C. Install risers, drops, offsets to avoid ductwork and structural components. Ductwork and structural systems shall take precedence to conduit.

D. Any exposed and visible conduit shall be parallel and perpendicular based on the lines of the building (such as ceiling lines, wall blocking lines, or architectural feature lines) using structural systems to conceal conduit visibility at all opportunities.

E. Concealed conduit shall be run in as direct manner as possible, using long bends. All bend radii shall be 12x conduit diameter. Condulets in lieu of elbows where ease of installation and appearance warrant their use – confirmation with architect is required for this use.

F. Conduit shall be continuous, with no more than (4) quarter bends between terminals, cabinets, boxes, or pullboxes is acceptable. Contractor is expected to provide wireway or boxes at appropriate intervals, in accordance with NFPA 70 for wire bending space. All conduit shall be electrically continuous throughout, including across boxes and cabinets. Terminals of all conduit shall be provided with double lock nuts and bushing, or terminated on conduit hubs. Use of Running Threads prohibited.

3.3 CONDUIT CORROSION PROTECTION

A. Branch circuit conduits installed in concrete slabs on fill or grade shall be positioned in a manner to ensure complete concrete cover. In no case shall such conduits be exposed below or above the slab surfaces, or penetrate the waterproof membrane.

B. At locations where metallic conduits pass through slabs on grade or transitions below grade, PVC coated rigid galvanized conduit shall be used.

C. Conduit installed in the air gap between the water-resistant barrier and finish brick shall not exceed 2-ft. in length.

3.4 EXPANSION JOINTS

A. Install approved expansion fitting in all conduit runs in excess of 150 feet or when crossing building expansion joints.

3.5 OUTLET AND JUNCTION BOXES

A. Provide an approved galvanized outlet box with adequate volume for number of conductors installed.

B. Provide standard galvanized switch boxes of the required number of gangs. Switch boxes where conduit is exposed shall be handy boxes or approved equal.

C. Outlet boxes for receptacles shall be similar to Universal 52151 with suitable raised cover. Receptacle boxes where conduit is exposed shall be handy boxes or approved equal.

D. Weatherproof boxes shall be FS or FD. Provide these boxes in all non-conditioned areas, exterior areas and natatoriums.

E. Outdoor boxes shall be NEMA 3R, with conduit connections made by Myers Hubs.

F. See notes and details on Drawings for special box requirements.

G. Provide junction boxes required to facilitate installation of the various conduit systems. Provide support boxes required for risers, each complete with approved cable supports as described elsewhere in this Division.

H. Outlet boxes for drywall shall be standard galvanized 4" square boxes with the appropriate device cover. Secure all outlet boxes with a backing brace connected to two adjacent studs. Mounting brackets with a single ear to rest against the backing sheet rock are not acceptable.

I. Provide floor outlet fittings for telephone to match fittings for duplex floor receptacles.

J. Provide 3-1/2” deep gangable masonry boxes in all masonry wall (CMU). Steel City GW-135-G or approved equal.

K. Provide shallow 4”x4” boxes in all demountable partitions.

L. Metallic boxes located in fire rated walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between metallic boxes may be reduced when “ Wall Opening Protective Materials” (CLIV) are installed according to the requirements of their Classification. Metallic boxes shall not be installed on opposite side of walls or partitions of staggered stud construction unless “Wall Opening Protective Materials” are installed with the metallic boxes in accordance with Classification requirements for the protective materials.

M. Junction, pull boxes, condulets, gutters, disconnects, contactors, etc., above 2-foot x 2-foot grid ceilings shall be mounted within 18-inches of ceiling grid. Above 2-foot x 4-foot grid ceiling they shall be mounted within 30-inches of ceiling grid. All junction box, pull box, gutter openings shall be side or bottom accessible.

N. Junction boxes are prohibited above drywall or plaster ceilings except for lighting; and those must be mounted directly over light fixture opening. Route power, PA, fire alarm conduits to nearest lay-in ceiling.

3.6 THRU-WALL SEALS

A. Provide O.Z. Gedney “Thru-wall” seals for all conduits passing through concrete structure below grade, above grade, and floor penetrations below grade. These prevent moisture from entering the building.

B. Straight sleeves are not acceptable.

3.7 PULL BOXES

A. Interior Pull boxes shall be provided for conduit systems as required and shall be constructed of galvanized steel of not less than gauge and size specified by National Electrical Code. Size pull boxes per Article 314.28 - NFPA 70.

B. Where two or more feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation.

C. Exterior in-ground pull boxes shall have open bottoms with sand and rock beds below box for drainage of water. Provide closed bottom boxes where specified. Closed bottom boxes shall be provided with sumps for portable pump to allow for extracting water. Refer to details on the drawings.

D. Pull boxes mounted in pole bases shall be coordinated with the pour of the pole base and shall be flush with finished footing.

3.8 WIREWAYS

A. Wireways shall be installed as indicated or required and locations shall be coordinated with architect.

B. Wiring in wireways shall be neatly bundled, tied and suitably tagged.

3.9 UNDERGROUND DUCTBANK SYSTEM

A. DUCT SYSTEM

1. The duct system shall consist of Schedule 40 PVC or type 1-EB PVC conduits encased in red concrete as detailed on the drawings. Use rigid conduit for stub-ups and the last ten feet at the end of each ductbank. Duct lines shall be laid to a minimum grade of 4 inches per 100 feet and shall be free from either horizontal or vertical waves. Duct lines shall be straight unless otherwise noted on the drawings. Duct lines shall be installed so that the top of concrete in encased duct lines is not less than 24 inches below finished grade or finished paving at any point. Changes in direction or runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 5 feet. The long sweep bends may be made up of one or more curved or straight sections and/or combinations thereof using five degree angle couplings. Conduit shall be thoroughly cleaned before using or laying. During construction and after the duct line is completed, the ends of the conduit shall be plugged to prevent water washing mud into the conduits. Particular care shall be taken to keep the conduits clean of concrete, dirt, and any other substance during the course of construction.
2. Each single conduit of the duct bank shall be completely encased in steel reinforced concrete as indicated. The thickness of concrete encasement indicated is the minimum thickness, and may be increased to fit the actual shape of trench.

3. Concrete for duct bank envelopes shall be standard 2000 psi concrete mix as described in Division 03, and be colored deep red for permanent marking of underground electrical work. The concrete red pigment shall be pure inorganic natural metallic base pigment, approved by the Engineer before use. Organic pigments will not be permitted. The approved pigments shall be mixed four pounds per yard of cement.
   a. Envelopes may be poured directly against sides of trenches if the "cut" is clean, even and free of loose material. All loose dirt and extraneous material shall be removed from the trenches before and during the pouring of concrete to ensure sound envelopes. Concrete shall be carefully spaded during pouring to eliminate all voids under and between the conduit and honeycombing of the exterior surfaces. Power driven tampers of agitators shall not be used, unless specifically designed for the application, in order to ensure that the water-tightness of the conduits is not destroyed.
   b. Generally, each run of envelopes shall be poured in one continuous operation. Where more than one pour is necessary, each pour shall terminate in a vertical plane. Partial pours shall not terminate in horizontal or angular planes.

B. For normal underground installation see Section 26 02 00, paragraph 3.1 for Excavating and Backfilling.

END OF SECTION

SECTION 26 05 73

SHORT CIRCUIT COORDINATION STUDY ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 SCOPE

A. The Contractor shall furnish short-circuit and protective device coordination studies as prepared by the equipment manufacturer.

B. The Contractor shall furnish short-circuit and protective device coordination studies for the electrical power system, including all existing and newly installed electrical equipment. The analysis and study shall include all distribution branches, and begin at the main building disconnect switch, or main 12KV feeder breaker, whichever is the higher main disconnect device for the structure to be studied.

C. Provide a complete short circuit study, equipment interrupting or withstand evaluation, and protective device coordination study for the power distribution system. Normal operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly addressed in the study. The study shall assume all motors operating at rated voltage and speed. Electrical equipment bus impedance shall be assumed as zero. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the switchboard busses and motor control centers (where installed).

D. A protective device coordination study shall be performed to determine appropriate relay settings. The study shall include all distribution switchboards, motor control centers (where installed, and panel board main circuit breakers. Panel board branch circuit devices need not be considered. The phase over current and ground fault protection shall be included as well as setting for all other adjustable protective devices.

E. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents.

F. Any problem areas or inadequacies shall be promptly brought to the ENGINEERS attention.

G. The Contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

1.2 REFERENCES

A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
2. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

3. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis
4. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings
5. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
6. IIEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations

B. American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
4. ANSI C37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C. The National Fire Protection Association (NFPA)

1. NFPA 70 - National Electrical Code, latest edition
2. NFPA 70E - Standard for Electrical Safety in the Workplace

1.3 SUBMITTALS FOR REVIEW/APPROVAL

A. The short-circuit and protective device coordination studies shall be submitted to the design Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

1.4 SUBMITTALS FOR CONSTRUCTION

A. A.The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. No more than five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Additional copies, where required, shall be provided on CD in PDF format.

B. The report shall include the following sections:

1. One-line diagram
2. Descriptions, purpose, basis and scope of the study
3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties
4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection

5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout
6. Incident energy and flash protection boundary calculations
7. Recommendations for system improvements, where needed
8. Executive Summary.
9. Equipment manufacturer's information used to prepare study
10. Assumptions made during study.

1.5 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies. The Registered Professional Electrical Engineer shall be a full-time employee of the Engineering Services Organization.

PART 2 - PRODUCT

2.1 STUDIES

A. The Contractor shall furnish short-circuit and protective device coordination studies as prepared by the equipment manufacturer.

B. The Contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

2.2 DATA COLLECTION

A. The Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B. Source combination may include present and future motors and generators.

C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner or Contractor.

D. Include fault contribution of existing motors in the study, with motors <100 hp grouped together. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE 141-1993.

B. Transformer design impedances shall be used when test impedances are not available.

C. Provide the following:

1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics
5. Typical calculations
6. Tabulations of calculated quantities
7. Results, conclusions, and recommendations.

D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:

1. Electric utility's supply termination point
2. Incoming switchgear
3. Low voltage switchgear
4. Motor control centers
5. Branch circuit panelboards
6. Other significant locations throughout the system.

E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short circuit ratings
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
3. Adequacy of transformer windings to withstand short-circuit stresses
4. Cable and busway sizes for ability to withstand short-circuit heating
5. Notify Owner in writing of any new or existing circuit protective devices improperly rated for the calculated available fault current.

2.4 PROTECTIVE DEVICE COORDINATION STUDY

A. Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.

B. Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

D. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E. Plot the following characteristics on the curve sheets, where applicable for this project:

1. Electric utility's protective device

2. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
3. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
4. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters
5. Conductor damage curves
6. Ground fault protective devices, as applicable
7. Pertinent motor starting characteristics and motor damage points
8. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center.

F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.5 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E-2004, Annex D.

B. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.

C. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

D. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 75 kVA.

E. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

F. The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

G. Arc flash computation shall include both line and load side of main breaker calculations, where necessary.

H. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2018 section B.1.2.

2.6 REPORT SECTIONS

A. Input Data:

1. Short-circuit reactance of rotating machines
2. Cable and conduit materials
3. Transformers
4. Circuit resistance and reactive values.

B. Short-Circuit Data:

1. Source fault impedance and generator contributions
2. X to R ratios
3. Asymmetry factors
4. Motor contributions
5. Short circuit kVA
6. Symmetrical and asymmetrical fault currents.

C. Recommended Protective Device Settings:

1. Phase and Ground Relays:
   a. Current transformer ratio
   b. Current setting
   c. Time setting
   d. Instantaneous setting
   e. Specialty non-overcurrent device settings
   f. Recommendations on improved relaying systems, if applicable
2. Circuit Breakers:
   a. Adjustable pickups and time delays (long time, short time, ground)
   b. Adjustable time-current characteristic
   c. Adjustable instantaneous pickup
   d. Recommendations on improved trip systems, if applicable.

D. Incident energy and flash protection boundary calculations

1. Arcing fault magnitude
2. Device clearing time
3. Duration of arc
4. Arc flash boundary
5. Working distance
6. Incident energy
7. Hazard Risk Category
8. Recommendations for arc flash energy reduction

PART 3 - EXECUTION

3.1 FIELD ADJUSTMENT

A. The Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Owner in writing of any required major equipment modifications.

D. Following completion of all studies, acceptance testing and startup by the field engineering service division of the equipment manufacturer, a 2-year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

3.2 ARC FLASH WARNING LABELS

A. The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B. The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD”, and shall include the following information:

1. Location designation
2. Nominal voltage
3. Flash protection boundary
4. Hazard risk category
5. Incident energy
6. Working distance
7. Engineering report number, revision number and issue date.

C. Labels shall be machine printed, with no field markings.

D. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

1. For each 600, 480 and applicable 208 volt panelboards, one arc flash label shall be provided.
2. For each motor control center, one arc flash label shall be provided.
3. For each low voltage switchboard, one arc flash label shall be provided.

E. Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.3 ARC FLASH TRAINING

A. The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

END OF SECTION

SECTION 26 09 36

LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SCOPE

A. Electrical contractor shall provide a complete lighting control system that controls interior and exterior lighting fixtures, including emergency fixtures. All lighting controls shall be stand-alone, and shall not have any communication with adjacent spaces. It is the contractor's responsibility to provide a complete and functional system, including, but not limited to all room controllers, switch packs, power packs, occupancy sensors, low voltage control stations, low voltage control cable, even if not specifically called out on the plans.

1.2 SUMMARY

A. Section Includes:

1. Digital Occupancy Sensor Control
2. Emergency Lighting Control
3. Control Intent – Control Intent includes, but is not limited to:
   a. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
   b. Initial sensor and switching zones
   c. Initial time switch settings

1.3 RELATED SECTIONS

A. Drawings and general provision of the Contact, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section

B. Section 26 02 00 - Basic Materials and Methods for Electrical

C. Section 26 05 19 - Wire, Cable and Related Materials: line and low voltage conductors, dimming conductors, securement requirements.

D. Section 26 27 26 - Wiring Devices

E. Section 26 29 26 - Miscellaneous Electrical Controls and Wiring

F. Section 26 51 19 - Lighting Fixtures

1.4 REFERENCES

A. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ICC (IECC) - International Energy Conservation Code.

C. NFPA 70 - National Electrical Code.

D. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

E. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control.

F. UL 924 - Emergency Lighting and Power Equipment.

G. UL 1008 - Transfer Switch Equipment.

H. UL 1598 - Luminaires.

1.5 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control system as defined under this section covers the following equipment:

1. Room Controllers – Self-configuring and field-configurable, one, two or three relays controllers, 0-10 volt control for drivers (if applicable).
2. Low Voltage Occupancy/Vacancy Sensors – Self-configuring or field-configurable, Low Voltage, calibrated occupancy sensors, Dual technology or PIR as described by this specification.
3. Low Voltage On/Off Switches – Self-configuring or field-configurable, Low Voltage pushbutton switches, that may contain one, two, three, or four control zone capability per device.
4. Low Voltage On/Off Dimmer Switches – Self-configuring or field-configurable, Low Voltage pushbutton switches, Dimmer and scene switches that may contain one, two, three, or four control zone capability per device.
5. Configuration Tools – Handheld remote for room configuration provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have, at a minimum, simple pushbutton interface and allow send/receive of room variables and occupancy/vacancy/photo/daylight sensor settings.
6. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building. Under loss of normal power, the ELCU shall bypass any control device and ensure fixtures are enabled at 100% light output. Comply with UL 924 and UL 1008 as applicable for each instance. Comply with 26 51 19.

B. System shall accommodate the square-footage coverage requirements for each area controlled, utilizing power packs, occupancy and vacancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.

C. System shall conform to requirements of NFPA 70.

1.6 SUBMITTALS

A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.

B. Shop Drawings:

1. Composite wiring and/or schematic riser diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).

2. Scale drawing for each area showing exact location of each sensor, room controller, and digital switch.
3. Riser diagrams to express lighting control hardware and wiring required to meet lighting control sequence of operations.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:

1. Indicates where sensor is proposed to be installed.
2. Prove that the sensor is suitable for the proposed application.

1.7 QUALITY ASSURANCE

A. Manufacturer: Minimum 7 years experience in manufacture of lighting controls, unless specifically listed in this specification.

B. Lighting controls shall meet the minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P as applicable.

1.8 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 0° to 40° C (32° to 104° F).
2. Relative humidity: Maximum 90 percent, non-condensing.

1.9 WARRANTY

A. Provide a five year complete manufacturer's warranty on all products to be free of manufacturers' defects.

1.10 MAINTENANCE

A. Spare Parts:

1. Provide 3 spares of each product listed below to be used for maintenance.
   a. Room Controllers
   b. Power packs
   c. Occupancy Sensors
   d. Low voltage on/off switches
   e. Low voltage on/off/dimmer switches
   f. Low voltage wall sensor switch

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. WattStopper

B. Acuity Brands

C. Cooper/ILC/Greengate

D. Sensorworx

E. Steinel

F. ETC

2.2 ALL OCCUPANCY SENSORS (CEILING OR WALL SWITCH)

A. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.

B. Passive infrared sensors shall utilize Processing protocols to respond only to those signals caused by human motion.

C. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).

D. Where specified, passive infrared ultrasonic and dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.

E. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

F. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within ± 0.005% tolerance, 32 kHz within ± 0.002% tolerance, or 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

G. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

H. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

I. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

J. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

K. All sensors shall have UL 94V-0 rated plastic enclosures.

L. Outdoor sensors shall have UL 773A ratings. EWF outdoor sensors shall additionally have UL 1598 ratings.

M. Outdoor sensors shall have an operating temperature range of -40°F to +130°F

N. To ensure complete protection from weather elements and exposure, outdoor sensors shall be rated and listed for outdoor use.

O. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology room system. No additional configuration will be required.

P. All devices shall be hard wired. No wireless devices shall be permitted.

2.3 WALL-SWITCH OCCUPANCY SENSOR

A. Manual-ON, Automatic-OFF dual technology (passive infrared and ultrasonic) wall switch occupancy sensor. Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled;

B. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.

C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts and shall have 180˚ coverage capability.

D. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.

E. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.

2.4 WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A. Ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. provide the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, occupancy sensors and accessories which suit the lighting and electrical system parameters. Passive infrared only sensors shall not be used for classroom applications.

B. Occupancy Sensors shall provide Features include the following: digital or analog calibration and pushbutton/dip-switch/dial programming for the following variables:

1. Sensitivity – 0-100% in 10% increments
2. Time delay – 1-30 minutes in 1 minute increments
3. Test mode – Five second time delay
4. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
5. Walk-through mode

6. Load parameters including Auto/Manual-ON, and daylight enable/disable when photosensors

C. Device Status LEDs including:

1. PIR Detection
2. Ultrasonic detection
3. Configuration mode
4. Load binding

D. Manual override of controlled loads.

2.5 WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 6 button configuration; available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED on each switch that blinks to indicate data transmission.

B. RJ-45 ports, or other manufacturer provided wiring method, for connection of devices on a common system.

C. Plug and play technology. Devices in the same room may be interconnected together and operate in default mode without any programming. Devices in a common space may be connected together, in a manner to be described and installed by the manufacturer's installation guidelines and requirements.

2.6 ROOM CONTROLLERS

A. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers shall be simple to install and may contain dip switches, potentiometers, or other easily adjustable field devices to allow for easy modification. All shall include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
3. Quick installation features including:
   a. Standard junction box mounting
   b. Quick low voltage connections using standard RJ-45 patch cable
4. Plenum rated
5. Manual override and LED indication for each load
6. Dual voltage (120/277 VAC, 60 Hz)

7. Zero cross circuitry for each load.

B. On/Off/Dimming enhanced Room Controllers shall include:

1. Real time current monitoring
2. One, two or three relay configuration
3. Efficient 250 mA switching power supply
4. RJ-45 local ports or other manufacturer provided wiring connection methods for connection to other devices on the same system.
5. One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.
6. The following dimming attributes may be changed or selected using a wireless configuration tool:
   a. Establish preset level for each load from 0-100%
   b. Set high and low trim for each load
   c. Set lamp burn in time for each load up to 100 hours
7. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
   a. One relay configuration only
   b. Automatic-ON/OFF configuration

2.7 POWER PACKS

A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of five (5) sensors.

B. Relay Contacts shall have ratings of 20A, 16A continuous, LED Lighting loads that can be fed by common 5-20R receptacles.

C. Control wiring between sensors and controls units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not begin installation until measurements have been verified and work areas have been properly prepared.

B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.2 INSTALLATION

A. Contractor must arrange virtual or phone meeting with the manufacturer before project rough-in to ensure the hardware, cabling, and overall system requirements are understood and met.

B. All line voltage connections shall be tagged to indicate circuit and switched legs.

C. Test all devices to ensure proper communication.

D. Electrical contractor shall calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

E. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

F. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

G. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

H. Contractor shall provide to the manufacturer all quantities for system including but not limited to relays, room controllers, relay panels, plug load controllers, switches, sensors and wire lengths and configurations for device cable at least 1 week before bid.

I. Install all devices as required by manufacturer submitted shop drawings and installation guidelines. Wiring details included with the construction documents are for general scope of work, and exact wiring and connections may vary by manufacturer.

J. The contractor shall coordinate rough-in size and quantity with the number of devices necessary. Since many control devices may accommodate multiple switch legs in a single gang, there may be an indirect relationship between number of devices and number of control zones.

K. Provide J-hooks for supporting all low-voltage cabling at a spacing not to exceed 5 ft. between hooks.

L. Provide dimming conductors for all dimming zones, as indicated by presence of dimmer devices on the plans.

M. The lighting control system must function within the guidelines stated in the lighting control sequence of operation notes, details, matrices, and narratives on the plans.

3.3 COMMISSIONING

A. Upon completion of the installation, the system shall be commissioned by a commissioning agent representative who will verify a complete fully functional system is installed as required by plans and specifications.

B. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

END OF SECTION

SECTION 26 21 13

ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. Power company fees shall be paid by Owner.

C. Provide electrical service to comply with contract documents and the power company standards.

1.2 SCOPE

A. RELATED WORK:

1. Basic Electrical Materials and Methods.
2. Earthwork
3. Division 1

B. Permanent Power: Contractor shall coordinate with the power company to provide electrical service to the building or campus as shown on the drawings. Contractor shall coordinate with power company and submit all required documentation; and shall establish the sequence of work to obtain permanent power.

C. Temporary Power: Provided by the contractor.

1.3 PERMITS, CODES, LAWS AND ORDINANCES

A. NFPA-70, NEC, State and local.

1.4 MINIMUM COMPLIANCE STANDARDS

A. Easements required by power company.

B. Duct bank required by power company.

PART 2 - PRODUCTS

2.1 ELECTRICAL SERVICE

A. SERVICE TRANSFORMER: Exterior Pad Mount

B. POWER COMPANY: Pedernales Electric Cooperative (PEC).

C. SOURCE VOLTAGE: 208Y/120 volt, three phase, four wire system.

2.2 METERS

A. Provide metering as required by Electric Utility Company Standards and requirements which may include self-contained meters and sockets, current transformers (CT's) and CT enclosures, bussed CT enclosures, transockets, meter modules, and bussed gutters and meter assemblies.

PART 3 - EXECUTION

3.1 SERVICE LATERIAL

A. Route service lateral underground to electrical service gutter and main service disconnect.

B. Provide electrical service gutter with above ground wireway with underground service laterals from gutter to all points of service delivery, as shown on plan.

3.2 COORDINATION

A. Confirm with power company exact locations of service entry and other requirements.

B. Provide all service laterals, whether above ground or below ground, in accordance with utility company engineered drawings. Information shown on contract documents may vary slightly from utility company engineered drawings and all utility company drawings and specifications shall supersede these contract drawings.

C. All electrical service infrastructure, up to the point of delivery, shall be installed per utility company standards. Plans and details included in these contract documents do not depict exact installation details as they may be required by the utility company.

3.3 CONCRETE PADS

A. Provide steel reinforced concrete pads with leave outs for conduits to comply with power company standards. Refer to Basic Materials and Methods.

3.4 INSTALLATION

A. Provide concrete encased Primary ductbank, including any and all steel reinforcement, conduit spacers and straps

B. Provide concrete encased secondary service lateral ductbank, including any and all steel reinforcement, conduit spacers and straps

C. All unmetered conductors shall be installed in rigid steel conduit, where installed above grade.

3.5 STEEL STRUCTURES

A. Provide galvanized steel structure embedded in concrete to support metering equipment and disconnect switches.

3.6 FIRE PUMPS

A. Provide a separate concrete encased service lateral to the fire pump controller.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. Provide panelboards as shown, scheduled and as specified herein.

B. The types of panelboards include:

1. Panelboards.
2. Power distribution panelboards.

REFERENCE STANDARDS

C. ANSI C12.1 - Electric Meters - Code for Electricity Metering.

D. ANSI C12.20 - American National Standard for Electricity Meters - 0.2 and 0.5 Accuracy Classes.

E. NFPA 70 - National Electrical Code.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.

G. UL 67 - Panelboards.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures.

I. UL 943 - Ground fault Circuit Interrupters

J. NEMA PB 1 - Panelboards

K. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

L. NEMA, ABI, Molded Car Circuit Breakers and Molded Case Switches

M. Federal Spec W-P 115, Rev C, Panel, Power Distribution

N. NEMA KSI, Enclosed and Miscellaneous Distribution Equipment Switches (600V)

1.2 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. General Electric Company/ABB
2. Square D Company

3. Siemens
4. Eaton

1.3 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of all enclosures, circuit breakers, fusible switches, bussing, rating, schedules and all accessories clearly labeled.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. NFPA 70
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General

1. Provide power distribution and panelboards as indicated in the panelboard schedule and as shown on the plans. Load centers are acceptable for use in dwelling units. Power distribution panelboards shall be equipped with fusible switches or circuit breakers as shown on the schedule. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.

B. Busing Assembly and Temperature Rise

1. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 65°C. rise above 40°C ambient. Heat rise test shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All current carrying parts of the bus shall be tin or silver plated copper.
2. Bus structure shall be isolated. Bus bar connections to the branch circuit breakers shall be distributed phase or phase sequence type and shall accept bolt-on circuit breakers for lighting and appliance panelboards.
3. The lugs for terminating conductors shall be rated at 75°C on all panel boards and circuit breakers.
4. Provide a non-insulated bare copper ground bus. Provide an isolated ground copper bus in each panel serving isolated ground circuits as indicated on panel schedule or one-line diagram. Provide a full size copper neutral bus in each panelboard enclosure. Provide a 200% neutral buss when served by a harmonic mitigating transformer and any K4 or higher rated transformers.

C. Distribution Panelboards

1. Provide arc energy reduction switch for each overcurrent device rated 1,200 amps or larger to comply with 240.87 of the NEC. Switch shall be equipped with a pad lockable cover with a blue LED pilot light that illuminates when system is activated. Locate switch and cover recessed mounted adjacent to the switch it serves or remote as indicated on the plans. Provide label and all required hardware. Remote switch(es) shall be flush mounted in wall near entry to the room.
2. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between “ON” and “OFF”. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Circuit breakers shall be of the frame size, trip setting and interrupting capacity as indicated on the drawings. Circuit breakers shall be rated 65,000 AIC unless otherwise noted on plans.
3. All fusible switches shall be quick-make, quick-break with visible blades and dual horsepower ratings. Switch handles shall physically indicate “ON” and “OFF” positions. Switches shall be lockable only in the “OFF” position and accept three industrial type heavy duty padlocks. Switch covers and handles shall be interlocked to prevent opening in the “ON” position. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Switches shall include positive pressure rejection type fuse clips for use with UL Class R fuses or Class J fuses and be UL labeled for 200,000 AIC.

D. 240 Volt Panelboards

1. Main breakers shall be vertically mounted. Branch mounted main breakers are not acceptable. Provide electronic trip mains with long term, short term and instantaneous trips as indicated on drawings and required for selective coordination.
2. Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2, or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions.
3. Circuit breakers shall be UL listed in accordance with UL 489 and shall be rated 240 volts ac maximum with continuous current rating as noted on the plans.
4. Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip settings of the breaker to prevent repeated arcing short resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac and carry the SWD marking.

5. UL Class A 5mA ground fault circuit protection shall be provided on all receptacle circuits serving wet areas and on all 120V ac branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker.
6. UL Class B 30mA ground fault circuit protection (GFEP) shall be provided on all equipment circuits requiring ground fault protection. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring.
7. Provide Shunt Trip Breakers including control power for circuits under cooking hoods and other equipment having this requirement.
8. Provide Breakers with Switched Neutral circuits with common trip for gasoline pumps and other equipment having this requirement.
9. Circuit breakers shall be rated 10,000 AIC at 240V unless otherwise noted on plans or served by transformers greater than 150 kVA.

E. Cabinets and Fronts

1. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL 50 for cabinets. Wiring gutter space shall be in accordance with UL 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Provide stainless steel front cover for all panels located in all Pool Equipment rooms, Food Labs, Snack Bars, Culinary Arts, Kitchens and Life Skills rooms. All NEMA-1 panels shall have hinged front covers. The front cover shall have a door with hinges, latch and a lock. The piano hinged front covers door-in-door shall allow full access to the circuit breaker gutter area without having to remove the entire front cover. All panelboard lock shall be keyed alike. Circuit breaker and fusible distribution panels shall have four-piece trims. A welded circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Provide NEMA 1 enclosure where installed indoors unless otherwise noted. Provide NEMA 3R enclosure where installed outside or in a sprinkled area.

F. Safety Barrier

1. The distribution panelboard interior assembly shall be dead front with panelboard cover removed. Main lugs or main breakers shall have a barrier. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

G. Integrated Equipment Short Circuit Rating

1. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the over-current devices mounted in the panelboard. The short circuit tests on the over-current devices and on the panelboard structure shall be made simultaneously by connecting the fault to each over-current device with the panelboard connected to its rated voltage source. Method of testing shall be per UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard over-current devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install panelboards, including electrical connections, in accordance with manufacturers written instructions, NFPA 70 and recognized industry practices.

B. All panels shall be mounted to unistrut. Unistrut shall be securely mounted to the floor and structural ceiling. Toggle bolts or anchor bolts attached to drywall is not acceptable.

C. Housekeeping Pads: Mount floor mounted panelboards on 4 inch high concrete housekeeping pads.

D. Fuses: Install fuses of the rating and class as shown in each fusible distribution panel scheduled on drawings.

E. Conduits: Stub up three one inch conduits to an accessible location above the ceiling for each recessed panelboard.

3.2 IDENTIFICATION

A. Nameplate: Each panelboard shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show panel designation. Nameplates shall be attached with stainless steel screws. Refer to Section 26 02 00, paragraph 2.8(C).

B. Directory Card: Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include location and name of each item of equipment served. Spares and spaces shall be written in erasable pencil for future use. Circuit directory shall show the room served by each circuit. The final graphs/signage room numbers shall be used. Do not use Architectural numbering on plans.

C. Replacement Components: Where circuit breakers or fuses are applied in compliance with the series combination ratings marked on the equipment by the manufacturers, the equipment enclosure(s) shall be legibly marked in the field to indicate the equipment has been applied with a series combination rating. The marking shall be readily visible and state "caution - Series Rated System." (NEC 110-22). Nameplate shall also identify replacement components.

D. Replacement Components: Nameplate shall identify replacement components.

3.3 INFRARED SCANNING

A. After Substantial Completion by not more than 2 months after Final Acceptance, perform an infrared scan of each panelboard. Remove fronts if not equipped with viewing ports to make joints and connections accessible to a portable scanner. Submit a copy the owner and engineer for review. If O&M manuals are submitted prior to performance of infrared scan, contractor shall submit a signed letter to verify the scan has been arranged. Letter shall indicate the scan provider and the date It will be performed.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SCOPE

A. Provide wiring devices as shown, scheduled, required and as specified.

B. The types of wiring devices required include:

1. Switches
2. Receptacles
3. Coverplates\
4. Floor boxes
5. Fire Rated Poke Through Devices

1.2 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).

C. NEMA WD 1 - General Color Requirements for Wiring Devices.

D. NEMA WD 6 - Wiring Devices - Dimensional Specifications.

E. NFPA 70 - National Electrical Code.

F. UL 20 - General-Use Snap Switches.

G. UL 498 - Attachment Plugs and Receptacles.

H. UL 943 - Ground-Fault Circuit-Interrupters.

I. UL 1310 - Class 2 Power Units.

J. UL 1699 - Arc-Fault Circuit-Interrupters.

1.3 QUALITY ASSURANCE

A. All wiring devices shall comply with NEMA WD 1 and NEMA WD 6 as well as FS W-C-596 and FS W-S-896 as applicable.

B. All switches shall comply with UL 20 as applicable.

C. All receptacles shall comply with UL 498 as applicable.

D. All GFCI receptacles shall comply with UL 943.

E. All USB charging receptacles shall comply with UL 1310.

F. All AFCI receptacles shall comply with UL 1699.

1.4 ACCEPTABLE MANUFACTURERS

A. Hubbell

B. Leviton

C. Pass & Seymour

1.5 SUBMITTALS

A. Shop drawings shall include but not be limited to:

1. Cut sheets of all devices indicating NEMA configuration, rating, materials, color, and all accessories.
2. Cut sheets of all coverplates indicating materials, color and any engraving specified on drawing or in the specifications.

1.6 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH

A. National Electric Code.

B. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. GENERAL

1. Provide factory assemble wiring devices with the rating type and color as required and specified for the service indicated.
2. Provide matching one-piece multiple gang plates where switches are ganged.
3. Provide wall plates for each receptacle furnished.
4. Architect reserves the right to select wiring device styles and colors to match wall finish.
5. Wall plates shall be of same manufacturer as devices.

2.2 SWITCHES

A. Provide specification grade White toggle switches where indicated on the Drawings. Coordinate exact locations with architect.

1. Wall switches shall be 20 amp, 120-277 volt and shall be Hubbell, Leviton or P&S as follows:

TOGGLE SWITCHES	HUBBELL	LEVITON	P&S
SINGLE POLE	HBL1221	1221-2	PS20AC1
DOUBLE POLE	HBL1222	1222-2	PS20AC2

THREE WAY	HBL1223	1223-2	PS20AC3
FOUR WAY	HBL1224	1224-2	PS20AC4
MOMENTARY CONTACT	HBL1557	1257	1251
THREE POSITION, TWO CIRCUIT MAINTAINED CONTACT	HBL1385	1285	1225
DISCONNECT SWITCH / INSTA HOT	HBL7810DS	MS303-DSS	7803

2. Dwelling units shall use Hubbell CS115I, CS120I, P&S CS15AC1, and CS20AC1.
3. Dimmers: Provide Lutron DIVA or equal as shown on drawings. Wall box dimmers shall be sized to handle the load served. Provide phase dimmers to control LED lamps when 0-10 volt dimming drivers are not provided.
4. Light Handle Switches: Provide Hubbell HBL1221-IL, Leviton 1221-LHC, P&S PS20AC1-ISl lighted handles to switch emergency lights where noted on the drawings.

B. Provide specification grade White decora style rocker switches where indicated on the Drawings. Coordinate exact locations with architect.

1. Wall switches shall be 20 amp, 120-277 volt and shall be Hubbell Decorator Series, Leviton, Decora or Pass & Seymor Decorator, as follows:

ROCKER/DECORATOR SWITCHES	**HUBBELL**	**LEVITON**	**P&S**
SINGLE POLE	DS120	5621-2	2621
DOUBLE POLE	DS220	5622-2	2622
THREE WAY	DS320	5623-2	2623
FOUR WAY	DS420	5624-2	2624
MOMENTARY CONTACT	HBL1557	1257	1251
THREE POSITION, TWO CIRCUIT MAINTAINED CONTACT	HBL1385	1285	1225
DISCONNECT SWITCH / INSTA HOT	HBL7810DS	MS303-DSS	7803

2. Dimmers: Provide Lutron DIVA or equal where required. Wall Box dimmers shall be sized to handle the load. Provide Phase dimmers to control LED lamps when 0-10V drivers are not provided.
3. Light Handle Switches: Provide Leviton 5649-2 or P&S 2625 lighted handles to switch emergency lights where noted on the drawings.

2.3 RECEPTACLES

A. Provide specification grade White receptacles where indicated on the drawings. Coordinate exact location with architect.

1. Receptacles shall be Hubbell, Leviton or Pass & Seymour as follows:

CONVENTIONAL RECEPTACLES	HUBBELL	LEVITON	P&S
HEAVY DUTY BRASS MOUNTING YOKE NEMA 5-20R DUPLEX	HBL5352	5362	5362
HEAVY DUTY BRASS MOUNTING YOKE NEMA 5-20R SIMPLEX	HBL5361	5361	5361
GFCI DUPLEX 20A, 125V SELF TESTING, FEED THRU CAPABLE, TAMPER RESISTANT FOR LOCATIONS REQUIRING TAMPER RESISTANT INSTALLATION OR AS INDICATED ON THE DRAWINGS	GFRST20	GFTR2	2097TR
GFCI DUPLEX 20A, 125V SELF TESTING, FEED THRU CAPABLE, TAMPER/WEATHER RESISTANT FOR INSTALLATION IN DAMP/WET LOCATION OR AS INDICATED ON THE DRAWINGS	GFTWRST20	GFWR2	2097TRWR
HEAVY DUTY TAMPER RESISTANT BRASS MOUNTING YOKE	HBL5362WTR	5362-SG	---
TAMPER RESISTANT 20A, 125V DUPLEX	BR20WHITR	8300-SG	TR63-H
USB CHARGER TYPE DUPLEX 20A, 125V TAMPER RESISTANT, DUAL USB TYPE C PORTS MIN. OF 5A USB OUTPUT, TAMPER RESISTANT	USB20CPDW 5A OUTPUT	T5835-W 6A OUTPUT	2TR20USBCC6W 6A OUTPUT
ARC FAULT CIRCUIT INTERRUPTER RECEPTACLES	AF20TRW	AFTR2-W	AF202TRW
GROUND FAULT CIRCUIT INTERRUPTER / ARC FAULT DUAL FUNCTION	AFGF20TR	AGTR2-W	AFGF202TR

B. Provide specification grade, Decora type White receptacles where indicated on the drawings. Coordinate exact location with architect.

1. Receptacles shall be Hubbell, Leviton, or Pass & Seymour as follows:

DECORATOR / DECORA RECEPTACLES	HUBBELL	LEVITON	P&S
DECORATOR DUPLEX 20A, 125V NEMA 5-15R SELF GROUNDING	DR20	16362	26342
DECORATOR SIMPLEX 20A, 125V NEMA 5-15R SELF GROUNDING	---	1635	26361

GFCI DUPLEX 20A, 125V SELF TESTING, FEED THRU CAPABLE, TAMPER RESISTANT FOR LOCATIONS REQUIRING TAMPER RESISTANT INSTALLATION OR AS INDICATED ON THE DRAWINGS	GFRST20	GFTR2	2097TR
GFCI DUPLEX 20A, 125V SELF TESTING, FEED THRU CAPABLE, TAMPER/WEATHER RESISTANT FOR INSTALLATION IN DAMP/WET LOCATION OR AS INDICATED ON THE DRAWINGS	GFTWRST20	GFWR2	2097TRWR
TAMPER RESISTANT DUPLEX 20A, 125V NEMA 5-20R	DR20WHITR	16362-SG	TR26362
USB CHARGER TYPE DUPLEX 20A, 125V TAMPER RESISTANT, DUAL USB TYPE C PORTS MIN. OF 5A USB OUTPUT, TAMPER RESISTANT	USB20CPDW 5A OUTPUT	T5835-W 6A OUTPUT	2TR20USBCC6W 6A OUTPUT
ARC FAULT CIRCUIT INTERRUPTER RECEPTACLES	AF20TRW	AFTR2-W	AF202TRW
GROUND FAULT CIRCUIT INTERRUPTER / ARC FAULT DUAL FUNCTION	AFGF20TR	AGTR2-W	AFGF202TR

TIMER SWITCHES

C. Intermatic spring wound countdown timer, 4 hour max. Locations indicated on lighting plan and site plan.

D. The time switch shall be rated for indoor and outdoor usage.

E. The time switch shall be single pole singe throw (SPST).

2.4 COVERPLATES

A. Furnish and install coverplates on all outlet boxes. Oversize (Jumbo) coverplates are not acceptable.

B. Coverplates shall be smooth nylon and 302/304 smooth stainless steel in kitchen and coffee bar areas.

C. Provide Hubbell WP Series, Bell, Carlon or Leviton NEMA 3R weatherproof coverplates on all exterior wiring devices. Enclosure shall be suitable for wet locations when in use.

D. Coverplates shall be Hubbell SS Series, Leviton, Pass & Seymour 302/304 smooth stainless steel on all receptacles 30 amps and larger.

E. Stainless steel device plates shall be provided at locations with tile or stone walls.

2.5 FLOOR BOXES

A. Floor boxes with surface activation shall be cast iron as manufactured by Hubbell or equal by Wiremold 880CS/CM series and as indicated below:

1. Slab at grade (dual level, fully adjustable type 1).
   a. Single gang: #B-2436 w/#SB-3083 carpet flange.
   b. Two gang: #B-4233 w/#SB-3084 carpet flange.
   c. Three gang: #B-4333 w/#SB-3085 carpet flange.
2. Slab above grade (shallow, fully-adjustable, type II)
   a. Single gang: #B-2421 w/#SB-3083 carpet flange.
   b. Two gang: #B-2422 w/#SB-3084 carpet flange.
   c. Three gang: #B-2423 w/#SB-3085 carpet flange.
3. Cover plates shall have brass finish as follows:
   a. #S-3825 for duplex flap for duplex receptacles.
   b. #S-3826 for data/communications.

B. PVC floor boxes manufactured by Hubbell or equal shall be as follows:

1. Provide CFBS1R4CFB dual service cast iron body floor box with PVC riser. Provide CFBS1R4CUP adjustable mounting cup, S1R4SP2X2DUPLEX sub-plate for (1) Duplex and (2) RJ-45 Keystone jacks OR S1R4SP2X2STYLE for (1) GFCI duplex, USB or Surge Device & (2) Keystone jacks, OR S1R4SPQUAD sub-plate with (4) 20A simplex receptacles, single and dual circuit wiring capability. Provide with CFBS1R4CVR cover, Color to be chosen by Architect.

   a. Maximum finished floor thickness (above top of box collar) with maximum adjustability is 1-1/2-inches at 5-inch, at 6-inches maximum adjustability is 1/2".

C. Floor boxes, recessed activation type, meet UL 514A scrub water requirements, shall be stamped steel with corrosion resistant finish, UL Listed for slab-on-grade installations, or stamped steel for above-grade installations as manufactured by Hubbell or equal by Wiremold RFB2-11 series and as indicated below:

1. Recessed Activation Slab at grade:
   a. Two gang: #CFB2G30CR or CFB2G30RCR (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange and Furniture Feed cover availability. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past 0.15” rise
   b. Four Gang: #CFB4G30CR or CFB4G30RCR (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange availability. Cover shall not exceed 0.15” rise. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.
2. Recessed Activation Slab above grade

a. Two Gang: #CFB2G30 or CFB2G30R (provisions for round cover), capable of up to 2" entry per gang. Flush flange, Surface flange and Furniture Feed cover availability. Surface Type Covers shall not exceed 0.15" rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15" rise.

b. Four Gang: #CFB4G30 or CFB4G30R (provisions for round cover), capable of up to 2" entry per gang. Flush flange, Surface flange availability. Cover shall not exceed 0.15" rise. Surface Type Covers shall not exceed 0.15" rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past 0.15" rise.

3. Service Fittings

a. Surface Style Rectangular for use with carpet, tile, VCT and other engineered floors, available with or without carpet insert and offer system's furniture feed type cover providing (1) 1-inch and (1) 2-inch threaded openings

b. Flush Style Rectangular for use with tile, finished concrete or Terrazzo floors, available with or without carpet insert and offer system's furniture feed type cover providing (1) 1-inch and (1) 2-inch threaded openings

c. Rectangular covers shall be powder coated in variety of common finishes, Aluminum, Black, Brass, Bronze and Satin Nickel.

d. Round Covers for use with all floor types Shall provide cable egress doors and systems furniture feed type cover providing (1) ¾-inch and (1) 2-inch threaded openings Round covers shall be plated metal in variety of finishes except Black (powder coated) Brushed Aluminum, Brass Plated, Bronze Plated, Satin Nickel Plated.

2.6 FIRE RATED POKE THROUGH DEVICES

A. Installations requiring 4-inch cored openings, poke thru devices shall be manufactured by Hubbell or approved equal, Hubbell S1R4PTFIT Recessed Activation poke thru with either S1R4SP2X2STYLE or S1R4SP2X2DUPLEX sub-plate for (1) 20A Duplex, GFCI OR USB 2 Port Duplex with (2) openings for (2) RJ-45 Jacks with S1R4CVR - color to be chosen by Architect.

B. Installations requiring 6-inch cored openings, with duplex power, shall be manufactured by Hubbell or Wiremold 6AT, Hubbell S1R6PTWZ-XXX Recessed Activation poke thru which includes S1R6SPW and S1RSSPZ sub plates and S1R6CVR cover, where XXX is finish. Color to be chosen by Architect. This includes (1) pre-wired 20A, 125 V duplex receptacle and (2) NEMA configured rectangular Decorator openings for telephone, signal or up to (12) Category 5e/Cat 6 RJ-45 Jacks.

C. Installations requiring 6-inch cored openings, with quad power, shall be manufactured by Hubbell or Wiremold 6AT, Hubbell S1R6PTDEH-XXX Recessed Activation poke thru which includes S1R6SPH and S1R6SPE sub-plates and S1R6CVR cover where XXX is finish. Color to be chosen by Architect. This includes (2) pre-wired 20A, 125 V duplex receptacles (quad) single, dual circuit capable and (1) NEMA configured rectangular Decorator opening for telephone, signal or up to (6) Category 5e/Cat 6 RJ-45 Jacks plus (2) additional Keystone openings for a total of (8) Category 5e/Cat 6 RJ-45 Jacks for this sub-plate

D. Installations requiring 8-inch cored openings, shall be manufactured by Hubbell or Wiremold 8AT, Hubbell S1R8PTFIT3 Recessed Activation poke thru offering (2) perimeter (outer) sub-plate locations and (3) standard NEMA configured openings in center sub-plate location allowing multiple combinations for power, data and A/V connectivity devices including acceptance for third party AV devices such as Crestron, FSR, Extron.

E. Poke thru devices with above floor service fittings shall be Hubbell PT7XC Series or Wiremold RC9 approved equal for 3-inch cored openings with FR280BKA Pedestal Service Fitting for (1) 20A, 125V duplex receptacle and (1) NEMA configured Decorator opening for telephone, signal or Cat 5e/Cat 6 data cables with RJ-45 jacks.

PART 3 - EXECUTION

3.1 WIRING DEVICE MOUNTING HEIGHTS

A. Unless noted to the contrary on plans, or directed otherwise during the progress of the Work, wiring devices shall be set as follows:

1. Switches 42" above finished floor.
2. Wall mounted receptacles shall be installed vertically at 15 inches to the bottom outlet above finished floor unless otherwise noted or as required by local codes.
3. Wall telephone outlets shall be mounted 15 inches to the bottom above finished floor unless otherwise noted. Mount even with wall mounted receptacles.
4. At locations above counters, set devices at 6 inches above to the centerline counter tops, verify exact mounting height with the architect.

3.2 INSTALLATION (REFER TO 26 05 33 FOR OUTLET BOX SPECIFICATIONS).

A. Wall switches shall be set in a suitable steel box and shall be installed on the strike side of the door as finally hung, whether so indicated on the Drawings or not.

B. Receptacles shall be installed in a suitable steel box.

C. The Architect reserves the right to relocate wiring device up to a distance of 5 feet from the location shown, before rough-in, without additional cost.

D. Provide multi-gang device covers at locations where devices gang together.

E. Device locations are indicated schematically on the drawings along with the type and mounting height. Final locations and mounting heights shall be coordinated with the Architect on the jobsite, and with shop drawings of equipment; including equipment to be furnished and installed by the Owner. Devices installed in walls covered with vinyl, fabric wallpaper or other special finishes shall be coordinated and verified with the Architect on the job site.

F. Stranded wire termination to switches, receptacles, devices and miscellaneous control devices shall be with an approved solderless terminal if clamp type securing is not possible (i.e. Sta-Con crimp on fork tongue connectors; Burndy Type TP-F).

G. All 20A, 120V receptacles in food service areas shall be GFCI.

H. Provide GFCI circuit breakers for all drinking fountain branch circuits where GFCI receptacles are not indicated on plan.

I. Provide ARC Fault circuit interrupters (AFCI) as required to comply with article 210.12 of NFPA 70. This shall include but not be limited to dwelling units and dormitories. AFCI breakers may be used.

J. Provide ground fault circuit interrupter (GFCI)/ARC Fault circuit interrupter (AFCI) dual function receptacles to comply with articles 210.8, 210.12 and 406.4 of NFPA 70.

K. Contractor shall indicate the circuit serving each wiring device. Provide a typewritten label located on the inside face of the coverplate for all recessed mounted devices and on the outside of the coverplate on all surface mounted devices.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 SCOPE

A. Provide fuses as shown and scheduled and indicate by this specification section and other specifications sections.

B. The type of fuses include:

1. 600 volt current limiting.
2. 250 volt current limiting.

1.2 STANDARDS

A. ANSI

B. UL

1.3 ACCEPTABLE MANUFACTURERS

A. Eaton Bussmann

B. Mersen

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of all fuses showing ratings and fuse curves.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 CURRENT - LIMITING FUSES

A. General: Provide 200,000 amp interrupting capacity current limiting fuses of the ampacity and voltage indicated and scheduled.

B. Mains, Feeders and Branch Circuits

1. Circuits 601 to 6000 ampere shall be protected by current limiting BUSSMANN HI-CAP Time Delay Fuses KRP-C. Fuses shall employ "O" ring as positive seals between the end bells and the glass melamine fuse barrel. The terminals shall be peened. Fuses shall be time-delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .1 seconds or less and be listed by Underwriters` Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class L.

C. Class J Fuses

1. Circuits 0 to 600 ampere shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses LPJ. All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuited clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes rRMS symmetrical. The fuses shall be UL Class J.
2. Motor Circuits - All individual motor circuits rated 600 amperes or less shall be protected by BUSSMANN LOW-PEAK LPJ. The fuses for 1.15 service factor motors shall be installed in ratings approximately 125% of motor full current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the motor full load current. Larger H.P. Motor shall be protected by BUSSMANN Type KRP-C HI-CAP Time-Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPJ installed in ratings approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class LPJ or L. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual-Element LPJ as shown on the drawings. The fuses shall be UL Class J.

D. Class RK1 Fuses

1. Circuits 0 to 600 ampere shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuited clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class RK1.

2. Motor Circuits - All individual motor circuits rated 600 amperes or less shall be protected by BUSSMANN LOW-PEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in ratings approximately 125% of motor full current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the motor full load current. Larger H.P. Motor shall be protected by BUSSMANN Type KRP-C HI-CAP Time-Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in ratings approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.
3. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual-Element LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

2.2 SPARES

A. Upon completion of the building the contractor shall provide the owner with spare fuses as shown below.

1. 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares.
2. BUSSMANN spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fuses: Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the job-site or from installation. All fuses shall be furnished and installed by the electrical contractor. All fuses shall be of the same manufacturer.

B. All fuses shall be installed in fuse holders.

END OF SECTION

SECTION 26 28 16

SAFETY AND DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE

A. Provide safety and disconnect switches as shown, scheduled and as specified herein.

1.2 STANDARDS

A. Products shall be designed, manufactured, tested and installed in compliance with applicable standards.

1. NEMA KS1 - Enclosed switches
2. Federal specification W-S-865C-Heavy duty switches

B. Products shall conform all applicable UL standards, including UL98 (standard for safety, enclosed and dead front switches) and shall be UL-labeled.

1.3 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. General Electric Company/ABB
2. Square D Company
3. Siemens
4. Eaton

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of switches with ratings, physical dimensions and all accessories clearly labeled.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install heavy duty type safety switches with the number of switched poles as indicated on the plans and specifications. All safety switches shall be NEMA Heavy Duty Type HD, and Underwriters Laboratories listed.

2.2 MATERIALS AND COMPONENTS

A. Switch Interior

1. All switches shall have switch blades that are fully visible in the "OFF" position when the door is open. Switches shall have removable arc suppressor where necessary, to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60ºC and 75ºC copper or aluminum cables. All switches blades and contacts shall be plated copper. Adjust fuse block to accept Class J fuses.

B. Switch Mechanism

1. Switches shall have a quick-make and quick-break operating handle and mechanism, which shall be an integral part of the box, not the cover. Padlocking provisions shall be provided for locking in the "OFF" position with at least three padlocks. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Handle position shall indicate if switch is "ON" or "OFF".

C. Neutral

1. Provide a solid neutral with the safety switch where a neutral is present in the circuit.

D. Ratings

1. Switches shall be horsepower rated for ac and/or dc as indicated by the plans. The fused switches shall have Class R rejection fuse clips or adjusted for Class J fuses. UL listed short circuit ratings of the switches, when equipped with Class R fuses, shall be 200,000 symmetrical amperes.

E. Enclosures

1. Indoor switches shall be furnished in NEMA 1 enclosures.
2. Outdoor switches, switches located in wet areas or sprinkled areas shall be furnished in NEMA 3R enclosures.

F. Electrical Interlock Contacts

1. Provide electrical interlock contacts on all disconnect switches serving motors in which remote VFDs are serving the motor. Provide conductors from contacts to the safe circuit inside the VFD. De-energizing the disconnect switch shall signal VFD to stop.

G. Service Entrance

1. Switch shall be suitable for use as service entrance equipment when installed in accordance with the National Electrical Code.

PART 3 - EXECUTION

3.1 GENERAL

A. Install safety and disconnect switches, including electrical connections, and fuses in accordance with manufacturer's written instructions, NEC and recognized industry practices.

B. Location: Install switches within sight of controllers.

C. Hubs: Provide bolt-on hubs for rainproof or wet area applications.

3.2 IDENTIFICATION

A. Nameplate: Each disconnect switch shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show equipment served. Nameplates shall be attached with stainless steel screws.

END OF SECTION

SECTION 26 29 26

MISCELLANEOUS ELECTRICAL CONTROLS AND WIRING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. Provide the various miscellaneous control devices, wiring and additional branch circuits as required, shown and specified.

B. The types of miscellaneous control devices and wiring include but not limited to the following.

1. Contactors
2. Relays
3. Photocells
4. Time switches
5. Additional control wiring and safety devices as shown and specified.
6. Connect power from fire alarm relays to starters to shut down air handling units.

C. WORK SPECIFIED ELSEWHERE:

1. Various control devices, of an electrical nature, for the safe operation and temperature control of the heating, ventilating, air conditioning and plumbing systems provided under Division 22 and Division 23.
2. All control wiring and conduit shall be furnished under Division 23. All power wiring 120 volt or larger shall be provided by Division 26.
3. Refer to building controls specification, Division 23 for scope of work required to be performed by Division 26 (electrical contractor).
4. Specification 26 05 19 - Wire, Cable and Related Materials.

1.3 REFERENCE STANDARDS

A. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts.

B. NFPA 70 - National Electrical Code.

C. UL 508 - Industrial Control Equipment.

D. UL 916 - Energy Management Equipment.

E. UL 924 - Emergency Lighting and Power Equipment.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. NFPA 70
2. Local municipal or state codes that have jurisdiction.
3. UL 916
4. UL 924

1.5 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. LIGHTING CONTACTORS AND RELAYS
   a. General Electric Company/ABB
   b. Square D Company
   c. Automatic Switch Company
   d. Eaton
   e. Siemens
2. PHOTOCELLS AND TIME SWITCHES
   a. Tork, Inc.
   b. Intermatic time controls

PART 2 - PRODUCTS

2.1 MATERIAL

A. GENERAL: This Section shall outline the basic installation of electric devices, conduit, boxes, fittings, and wiring required for complete interconnection of several systems, this may not reflect every required appurtenance. It does not cover integral parts of mechanical equipment.

B. CONTACTORS AND RELAYS: Provide control wiring, contactors, and relays with the ampere-rating and number of poles as shown, specified, and required for a complete and functioning system:

1. Rated at 600 volts, 60 hertz.
2. Continuously rated contacts for all types of ballast and tungsten lighting, resistance and motor loads. Contacts shall be sized as scheduled or noted.
3. Shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring.
4. The contactor shall have straight-through wiring with all terminals clearly marked.
5. The contactor shall be approved per UL 508 and/or CSA, and be designed in accordance with NEMA ICS 2-21 1B.
6. They shall be industrial-duty rated for applications to 600 volts maximum.
7. The contactor shall have provisions for factory or field addition of:
   a. Four (4) N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
   b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.

8. The contactor shall have a NEMA type 1 enclosure unless otherwise noted.
9. Control power to the contactor 120V control circuit shall be provided from the nearest panelboard 120V circuit. If the 120V control power circuit is not shown, provide a control power transformer for 120 volt control power and a 120 volt coil when required for control. Provide primary and secondary fuses on the control power transformer.
10. Electrically Held Lighting - Contactor coils shall be continuously rated and encapsulated. Electrically held contactors are not to be used unless specifically shown on the plans.
11. Mechanically Held Lighting Contactors - Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. All contactors shall be mechanically held unless noted otherwise on the plans.
12. Provide 2-wire or 3-wire control modules as required to operate lighting contactors.
13. Provide hand-off-automatic controls (H-O-A) for each lighting contactor.
14. Provide relays and contactors to shut down air handling units.

C. Photocells for Stand-alone controls (not part of relay panel controls): Provide a specification grade self-contained, weatherproof, photoelectric control that shall be mounted on an FS type weatherproof junction box. The photocell shall:

1. Switch "ON" at dusk and "OFF" at dawn.
2. Adjustable from 2 to 50 foot-candles.
3. Rated at 2,000 watts.
4. Use 1" diameter cadmium sulphide cell.
5. Have a 2-minute delay to prevent false switching.

D. TIME SWITCHES: Provide a 7-day digital time clock with battery back-up feature installed in a NEMA 3R enclosure.

E. Control wiring shall be not less than #14 AWG type THWN/THHN and shall be color coded and labeled with Brady markers throughout. Bundle multiple conductors with Ty-Raps.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install miscellaneous electrical controls and wiring to provide a functioning system.

B. Install contactor and relays in electrical/mechanical rooms unless otherwise noted.

C. Install photocells on the roof unless otherwise directed by the architect. Coordinate any roof penetrations with all other trades and shield from other light sources.

D. Provide miscellaneous connections for signs and other furnished equipment as shown on the Drawings.

E. Provide NEMA 3R enclosures where located outside.

F. Provide low-voltage cabling between relay panels and all control devices. Cabling shall be furnished by contractor as required by panel manufacturer, including Cat5, Cat6, Belden, dimming pairs, or other as required by the manufacturer. Pre-terminated cabling by manufacturer is acceptable.

G. All Low-Voltage cabling, for all systems, shall be neatly routed using J-Hooks. Cabling is installed above a hard ceiling, conduit shall be used to traverse the hard-ceiling segments.

H. Install photocells high on North Facing walls, or in accordance with manufacturer installation.

3.2 DIVISION 22, 23, 27 AND 28 MISCELLANEOUS POWER AND CONTROLS

A. Install electrical devices not an integral part of system equipment providing conduit, boxes, fittings, wiring, circuit breakers, disconnecting means and other devices.

B. Contractor is responsible for providing all line voltage power to devices that require electrical power to operate. Contractor shall terminate line voltage power to termination points. Contractor shall coordinate between all trades to determine sizing and quantities of line voltage circuits to adequately power and control devices. Provide circuits from nearest low voltage panel using spare circuits provided, if device requires power not already available or indicated.

C. Provide GFCI receptacle with weather proof cover within 25 feet of all heating, air conditioning and refrigeration equipment.

3.3 OPERATIONS PERSONNEL TRAINING

A. All relay panels require manufacturer technician time to meet with owner, set programming conditions, time of day operations, and ensure owner-intended operations are met, based on whichever is most appropriate based on project size:

1. 8-Hours per relay panel
2. The amount of time required to successfully meet the criteria of this section and result in a fully working system, accepted by the Owner.

B. A one-time recommissioning site visit, 4 Hours in time, by a manufacturer technician anytime between 90 and 120 days of building occupancy to adjust and reprogram (as required) the system based on owner input. This meeting shall be scheduled by the manufacturer and can only be declined by the owner.

C. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.

6. On site demonstration.

END OF SECTION

SECTION 26 32 13.16

LIQUID PROPANE STANDBY GENERATING SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B. SCOPE

1. Provide a standby electric generating system manufactured by Kohler 350RZXD series electric set rated for continuous standby service at 240kW/300kVA at 0.8 power factor, 3-phase, 208Y/120 volts, 60 cycle. The system shall be a package of new and current equipment consisting of:
   a. A liquid propane vapor driven electric plant in a (outdoor sound attenuated weather-protective housing) to provide emergency electric power.
   b. Automatic transfer switch to provide automatic starting and stopping of the plant and switching of the emergency load.
   c. Mounted accessories as specified.
   d. Control wiring.
   e. Provide oversized alternator as specified.
   f. Load bank.

1.2 PERMITS, TEST INSPECTIONS

A. This system shall be completely built, tested and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten years and who has parts and service facilities locally available so that there is one source of supply and responsibility. The performance of the electric plant shall be certified by an independent testing laboratory as to the plant's full power rating and voltage and frequency regulation. The complete system shall bear a seal showing that it is prototype test supported.

1.3 REQUIREMENTS

A. Level 1 applications are legally required emergency systems.

B. The electric generating system must meet all requirements of NFPA 110 (latest edition) including design specifications, prototype tests, one-step full-load pickup, and installation acceptance. Engine-generator system to provide source of power for Level 1 applications.

1.4 STANDARDS

A. Equipment shall meet the latest versions of the following codes:

1. NFPA 30
2. NFPA 37

3. NFPA 70
4. NFPA 99
5. NFPA 101
6. NFPA 110
7. IEEE C62.41.1
8. IEEE 446
9. NEMA MG 1, ICS
10. ANSI
11. UL 1008
12. UL 2200
13. MIL-STD 461 C - Part 9, IEC 801.2, IEC 801.3, IEC 801.5, IEC 1000-4-2,3,6 - RFI and EMI Performance.

1.5 SUBMITTALS

A. Provide a specification compliance document noting any deviations to the specification. Document shall be a copy of the specification noting Comply, Deviate, or Exception to each section with detailed explanation for each deviation and exception.

B. Shop drawings shall include but not be limited to:

1. Catalog cut sheets with all equipment, accessories and devices including all ratings.
2. Interconnection wiring diagrams.
3. Complete bill of materials.
4. Certified performance tests.
5. Sizing report using manufacturer software confirming the engine and alternator complies with the size required to supply the connected load. Submit alternate generator if the proposed unit will not comply. The generator shall not exceed 85% of the rated load.

C. Operation and Maintenance Data

1. Submit under provisions of Division One.
2. Furnish three copies of the manuals and books listed below in substantial three-ring binders for each unit:
   a. Operating Instructions: Describe and illustrate all switchgear controls and indicators and engine and general controls. Include instructions for operating transfer switch equipment under normal and emergency conditions when engine generator is running.
   b. Parts Books: Illustrate and list all assemblies, subassemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.).
   c. Preventative Maintenance Instructions: Describe the daily, weekly, monthly, biannual and annual maintenance requirements and include a complete lubrication chart.
   d. Routine Test Procedures: Describe procedures for engine, radiator, all electronic and electrical circuits, and the generator.
   e. Troubleshooting Chart: Describe and list all troubles, probable causes, and suggested remedies.

f. Recommended Spare Parts List: List all consumables anticipated to be required during routine maintenance and testing. List special tools, maintenance materials and replacement parts.

g. Wiring Diagrams and Schematics: Show function of all electrical components.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division One.

B. Accept units on site on skids. Inspect for damage.

C. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.7 ACCEPTABLE MANUFACTURERS

A. Provide products complying with these specifications and produced by the following:

1. Generator Manufacturer
   a. Rehlko
   b. Cummins
   c. CAT

2. Automatic Transfer Switches
   a. Rehlko
   b. ASCO
   c. Trystar

1.8 ACCEPTABLE SUPPLIERS

A. All equipment provided shall be supplied by an authorized distributor of the manufacturer who has been continuously engaged in the distribution of industrial grade power system products for a minimum of 15 years. The supplier shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier shall be authorized to perform warranty service on all products provided.

B. The supplier shall maintain a minimum of 6 factory trained and qualified field technicians within 50 mile of the job site, a proper supply of spare parts for the supplied equipment, a shop with overhaul capabilities; and be able to provide 24 hour, 7 days per week, 365 days per year field service capability.

PART 2 - PRODUCTS

2.1 ENGINE

A. The engine shall be radiator cooled, liquid propane fueled, 4 cycle, V-8 cylinder. It shall have a total piston displacement of not less than 632 cubic inches and develop not less than the recommended brake horsepower at its operating speed. A radiator air discharge duct flange shall be provided for a connecting duct to allow all heated air and gases to be discharged out of the building, or enclosure, through one opening. The radiator cooling system shall be rated at 104 degrees F. ambient against an external restriction of 0.5 inch water column. Engine cooling air requirements shall not exceed recommended CFM.

B. The engine shall be of 1-piece cast alloy iron construction with cast alloy iron heads. Valves shall be overhead and free to rotate. Valves shall be hard chrome-cobalt alloy faced with replaceable valve seat inserts of solid chrome-cobalt alloy. The crankshaft shall be forged steel. Main bearings provided between all cylinders. The connecting rods shall be forged steel with connecting rod bearings. Provide full-flow, replaceable oil filter with bypass. Oil pressure gauge shall be included.

C. The engine shall be equipped with adjustable isochronous electronic governor with speed regulation 0.25 percent, no load to full load, main output circuit breaker, fuel injection system with automatic fuel shut-off, and a reusable air element air cleaner.

D. Provide a 24 volt electrical system and electric starter.

E. 120 VAC thermostatically controlled water jacket heater system (1200 watts) shall be provided. Contractor shall install normal power to the heater.

F. Provide the following safety shutdown fault devices:

1. Low oil pressure
2. Over-speed
3. Over-crank
4. High temperature (with low water level)

G. Provide the following alarms:

1. Low engine temperature (indicating jacket heater malfunction)
2. Marginally high engine temperature
3. Marginally low oil pressure
4. Flashing light for control switch in "Stop" position.

H. Generator main circuit breaker shall be UL listed, set-mounted, factory connected, molded case type with electronic trip unit. Submittals shall demonstrate that the circuit breaker provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection. (Lugs on breaker shall match “ATS” lugs). Provide ground fault alarm for breakers rated 1000 amps and larger to comply with Article 700.6 (D) of the National Electrical Code

I. Provide output breaker for load bank.

2.2 ALTERNATOR

A. Rating 240kW/300kVA at 0.8 power factor, 105 degrees Celsius, 208Y/120 volts, 60 Hz at 1800 rpm.

B. The alternator shall be a single bearing revolving field type, 2/3 pitch, 4-pole and shall be completely brushless. No commutator or commutator brushes shall be allowed. The main alternator and exciter shall be vacuum impregnated. The alternator shall be directly connected to the engine through a rigid coupling to insure permanent alignment. Voltage regulation shall be within plus or minus 1% of rated voltage, from no load to full load. Voltage recovery to rated voltage after acceptance of 100% of rated load in one step shall occur within 10 seconds. Provide a permanent magnet generator (PMG) excitation system. Motor starting capability shall be a minimum KVA recommended by manufacture. Rating for non-linear loads shall not be less than manufacturers recommended kW at 0.8 power factor. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set. The instantaneous voltage dip shall be less than 10% of rated voltage when full load and rated power factor are applied to the alternator. Stable or study-state operation is defined as operation with terminal voltage remaining constant within plus or minus 1% of rated voltage. Temperature rise shall be within rating as defined by NEMA MG 1-22.40. Radio interference reduction shall exceed requirements for general civilian or commercial applications with TIF less than 50 and wave form deviation less than 0.06 line to line.

C. Provide a 120 volt anti-condensation heater (minimum of 100 watts) to prevent condensation during non-operating periods. Heater shall be thermostatically controlled and rated for continuous use for the frame. Provide normal power to the heater.

D. Overload Rating: Capable of withstanding a three phase load of 300% rated current for 10 seconds, 150% of rated current for 60 seconds and 105% rated current for 60 minutes with field set for normal rated load excitation, and capable of withstanding an overspeed of 125%.

E. Performance Criteria:

1. Wave form Deviation: Less than 5%.
2. Crest Factor: 1.41 +/- 0.07.
3. Form Factor: 1.11 +/- 0.05.
4. Total Harmonic Distortion: 5%.
5. Single Harmonic Distortion: 3%.
6. Telephone Interference Factor: 50% maximum.
7. Dynamic Balance: Less than 1 mil displacement peak to peak.

F. Enclosure: NEMA MG1, open drip proof.

G. Neutral Ground: As shown on drawings.

2.3 CONTROLS AND INSTRUMENTS

A. Provide comprehensive monitoring and control system integral to the Generator Set control to guard the electrical integrity of the alternator and power system. Provide single and 3-phase fault current regulation, so that downstream protective devices have the maximum current available to quickly clear fault conditions, without subjecting the alternator to potentially catastrophic failure conditions. Include provisions to either prevent over voltage due to single phase faults, or to shut down the generator set if line to neutral voltage on any phase exceeds 115% for more than 0.5 second. Acceptable methods are a 100% rated, 600 volt circuit breaker mounted in the generator enclosure. Provide size as indicated on drawings with handheld programmer or inherent protection provided by microprocessor-based AmpSentry protection. Submittals shall demonstrate that the protective device provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection.

B. A Generator Control Panel mounted on top of the alternator shall contain the following:

1. Run-stop-remote switch
2. Charge rate ammeter
3. Oil Pressure Digital Readout
4. Coolant Temperature Digital Readout
5. Remote start-stop terminals
6. Running time meter
7. Full A.C. Digital Display (A.C. ammeter, A.C. voltage, phase selector switch, frequency meter, and voltage adjustment.) All parameters shall have a readout of not less than 2.5% accuracy.
8. Red alarm lights shall be provided for each fault and alarm condition.
9. Two sets of spare terminals shall be provided for customer selected faults.
10. An Emergency Shutdown contact shall be provided through which customer's push button or other momentary-closing switch contacts shall shutdown the generator set engine.
11. A fault reset switch contacts shall shutdown the generator set engine.
12. A fault reset switch shall be provided to clear fault indications and allow restarting of the engine after shutdown faults.
13. The control design shall be such that the fault indication shall remain until reset. The fault indicator memory shall not be dependent on the presence of either AC or DC voltage and shall retain the fault status memory even through complete removal and replacement of the starting batteries.
14. A battery warning that includes load testing the battery on each crank shall be provided.
15. The fault reset function shall operate only when the RUN-STOP-REMOTE switch is in the STOP position.
16. All devices for interconnection and compatibility with digital accuracy and response shall be provided. Digital panels shall comply with electromagnetic interference requirements of Minimum Standard 461C - Part 9, and IEC Standard 801.2, 801.3 and 801.4. indication of voltage level

17. Include a full wave rectified automatic digital voltage regulation system matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate; and be capable of being curve-matched to the engine torque curve with adjustments in the field.
18. The automatic voltage regulator shall be temperature compensated, solid-state design and include overvoltage and overexcitation protection functions. The voltage regulator shall be equipped with three phase RMS sensing. The regulator shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. Overvoltage protection shall sense the AC generator output voltage and (in the event of regulator failure or loss of reference), shut down regulator output on a sustained overvoltage of one (1) second duration. Overexcitation protection shall sense regulator output and shutdown regulator output if overloads exceed ten (10) seconds in duration. Both overvoltage and overexcitation protection shutdowns shall be latched, requiring the AC generator to be stopped for reset.
19. The regulator shall include an under frequency rolloff torque-matching characteristics, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 Hz. The torque-matching characteristics shall include differential rate of frequency change compensation to use maximum available engine torque and provide optimal transient load response. Regulators which use a fixed volts per hertz characteristic are not acceptable.
20. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions.
21. All analog and digital metering shall be true-RMS indicating, and shall not be disrupted by non-linear load generated waveform distortion.
22. Digital metering set shall indicate generator RMS voltage and current, frequency, output current, output kW, kW-hours, and power factor. Generator output voltage shall be available in line-to-line neutral voltages and shall display all three phase voltages (line to neutral or line-to-line) simultaneously.
23. An under frequency sensing and protection system shall be provided which causes a shutdown of the generator set if true RMS frequency falls below 90% of rated frequency for more than 10 seconds.
24. The control system provided shall withstand the surge voltage produced by a 70A DC battery charging alternator operating at full load when the battery bank is disconnected. The test shall be successfully completed without tripping protective circuit breakers or blowing fuse protective devices.
25. All switches, lamps and meters shall be oil-tight and dust-tight and the enclosure door shall be gasketed.
26. All switches shall be provided with fully illuminated back-lit labels and all metering shall be individually lighted to allow for easy reading of functions in a completely dark room.

27. The field connections shall be made on permanently labeled terminal blocks, which are designed and tested by the manufacturer of the generator set to be suitable for use without wire termination lugs. Provisions shall be made for future addition of DIN-rail mounted components.
28. Control panel and interconnection enclosures shall be UL508 listed as a unit assembly.
29. Communications:
    a. Alarm Relay Mode: Provide Form C alarm contacts that can be individually linked to alarm or status outputs from the generator set to external devices.
30. Interface to Site Monitoring System: Provide necessary electronic components and wiring to interface with and communicate the analog and digital status information to an owner provided site monitoring system. Include in this contract all work required for translation of proprietary protocol required to achieve this interface, and all licensing or other fees associated with this interface. Provide ethernet connection for integrating into modbus protocol.

2.4 ELECTRIC PLANT MOUNTING

A. The plant shall be provided with shock or anti-vibration mounts with the plant. Provide Korfund LKD spring-type isolators or type EU pads. Vibration isolation may be integrally a part of the generator set to the skid package. The plant's integral base shall have forklift sockets. Battery rack shall be integral part of plant base.

2.5 REMOTE FUEL STORAGE TANK

A. Provide UL 2085 listed, 1000 gallon above grade freestanding, factory fabricate day fuel tank assembly, with integral, float-controlled transfer pump and the following features:

1. Containment: Integral rupture basin with a capacity of 150 percent of nominal capacity of day tank.
    a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of day-tank leak.
2. Provide a pump with a minimum 2 GPM with 20-foot of lift driven by ¼ HP or larger motor rated at 120volt.
3. Provided with On/Off/Emergency run switch, test/reset switch, AC Circuit Breaker, DB Circuit Breaker and the following indicator lamps:
    a. Ready (Green) - AC Supply and DC Control Power Available.
    b. High Fuel (Red) - Latching Fault, indicates fuel level near overflow, shuts down pump, and closes N / O dry contacts.
    c. Low Fuel (Red) - Latching fault, indicates pump failure or operating float switch failure, closes N / O dry contacts.
    d. Low Fuel Shutdown (Red) - Latching fault, indicates near empty tank, closes N / O contacts which may be used to shutdown engine generator to avoid air in the injection system.
    e. Overflow to Basin (Red) - Latching fault, indicates fuel in overflow / rupture basin, shuts down pump, closes N / O dry contacts.
    f. Spare (Red) - with N / O and N / C dry contacts.
    g. Pump Running (Green).
4. Provide factory-installed fuel supply and return lines from tank to engine; local fuel fill, and vent lines in compliance with local code requirements.

5. Provide remote fill port to refill the tank.

2.6 ACCESSORIES

A. All accessories needed for the proper operation of each plant shall be furnished. These shall include, but not limited to, the following:

1. Critical rated side inlet silencers with installation attachments for mounting within the set housing, flexible exhaust connection.
2. Belt driven battery charging alternator.
3. Lead acid starting batteries
4. Battery cables.
5. Fully automatic 120 volt, 10 amp battery charger. Kohler or approved equal.
6. Fuel Water Separator.
7. Flexible fuel lines for return and supply of fuel to the engine from the tank.
8. An oil drain valve with hose extension shall be provided for draining oil at the side of the plant.
9. Detailed operation and maintenance manuals with parts list.

2.7 REMOTE ALARM ANNUNCIATOR

A. Remote annunciator shall be provided for flush mounting at inside location remote from the generator set located by the fire alarm control remote annunciator panel in the front administration office area.

2.8 AUTOMATIC TRANSFER SWITCH

A. Scope

1. Provide open transition automatic transfer switches (ATS) with the number of poles, amperage, voltage and withstand current ratings as shown on the plans. Each automatic transfer switch shall consist of an inherently double throw power transfer switch unit and a control module interconnected to provide complete automatic operation.

B. Codes and Standards

1. UL 1008 - Standard for Automatic Transfer Switches
2. NFPA 70 - National Electrical Code
3. NFPA 99 - Essential Electrical Systems for Health Care Facilities
4. NFPA 110 - Emergency and Standby Power Systems

C. Acceptable Manufacturers

1. Relhko
2. ASCO
3. Trystar

D. Mechanically Held Transfer Switch

1. The transfer switch unit shall be electrically operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.
2. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction and be protected by separate arcing contacts.
3. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes.
4. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof are not acceptable.

E. Microprocessor Control Panel

1. The control panel shall direct the operation of the transfer switch. The panel's sensing and logic shall be controlled by a built-in microprocessor.
2. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall communicate with the engine generator, including display of all engine and alternator data, and other transfer switch data in the power system. The operator panel shall allow starting and stopping of the generator set via the transfer switch operator panel in both test and emergency modes.

F. Enclosure

1. The ATS shall be furnished in a NEMA4 for exterior use.

G. Voltage and Frequency Sensing

1. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 100% of nominal, and dropout adjustable from 75% to 98% of pickup setting.
2. Single-phase voltage sensing of the emergency source shall be provided, with pickup voltage adjustable from 85% to 100% of nominal and independent frequency sensing with pickup adjustable from 90% to 100% of nominal.

H. Time Delays

1. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Adjustable from 0 to 6 seconds.
2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.
3. A time delay shall be provided on retransfer to normal, adjustable from 0 to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.
4. A time delay shall be provided on shutdown of engine generator for cool down, adjustable from 0 to 60 minutes.

I. Additional Features

1. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal.
2. A momentary-type test switch shall be provided to simulate a normal source failure.
3. One set of auxiliary contacts rated 10 amps, 250 VAC shall be provided.
4. Position indicating lights shall be provided.
5. An in-phase monitor or delayed transition shall be provided for motor load applications.
6. Provide a field-programmable control which shall periodically start and run the generator with or without transferring the load for a preset time period, then re-transfer and shut down the generator after a preset cool-down period.

J. Withstand and Closing Ratings

1. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 3 cycle, long-time ratings. ATS's that are tested and labeled with specific breaker ratings only are acceptable. If current limiting fuses are utilized, provide current limiting fuses and disconnect switch mounted in or on Automatic Transfer Switch.

K. The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

2.9 LOAD BANK

A. Electrical Connection: Power source to load bank connection is 3-phase, 3-wire plus ground. Additional control wire connections for remote control as required.

B. Load Bank Rating:

1. Capacity: 90 kW, 1.0 p.f
2. Load Steps: 15 KW load step resolution
3. Voltage: 208 VAC, 3-ph., 3-W
4. Frequency: 60 Hertz
5. Air intake temperature: 155°F maximum (radiator air outflow)
6. Airflow requirements: Radiator air outflow
7. Duty Cycle: Continuous
8. Air temp. rise: 100°F, nominal
9. Air back pressure: 0.25 - 0.50" water column

C. Load Bank Design:

1. General: The load bank shall be a completely self-contained unit which includes all resistive load elements, load control devices, load element branch circuit fuse protection, main load bus and terminals, control terminals, system protection devices and enclosure of required type.

2. The load bank shall be the manufacturer's standard product that has been investigated, tested and listed by Underwriters Laboratories as a system for the purpose intended.
3. Enclosure: Type 3R, welded sheet steel, UL approved finish painted consisting of an epoxy primer and a polyurethane top coat, consisting of a power section, for installation and wiring of the load elements and a control section for installation and wiring of control components. The control section is to be physically and thermally isolated from both the hot load elements and the heated airflow. Mounting adapters suitable for the installation method selected shall be supplied with the load bank. The exhaust of the load bank shall be screened and, if installed outdoors, louvers shall be provided.
4. Load elements: Load elements shall be UL listed, labeled or recognized, Simplex Power Web Open wire, helically wound, chromium alloy, thermally derated to 60%. 5% tolerance, 2% balance. 0.995 p.f. element wire mechanically supported over entire length such that if a wire should break, the broken wire segments will not short to adjacent conductors or to ground. Load elements are individually serviceable and replaceable in the field without major disassembly of the load bank.
5. Load element short circuit protection: Branch circuit fuses, per each 50KW load branch circuit. Fuses shall be 200,000 A.I.C. current limiting type.
6. Load control: One magnetic contactor per each fused branch circuit.
7. Load bank power wiring shall be 150ºC insulated.
8. Main terminals: Plated bus bar with a hole pattern to accept customer supplied cable
9. Control wiring shall be 105ºC insulated.
10. Control power shall be derived internally from the main load bus. Control and protective circuits shall operate at 120V via control power transformer or line-neutral circuit and shall be fused.
11. System protection: The load bank shall include a comprehensive protection system to protect against overheating. The system shall function to disconnect the load elements from the power source and activate an alarm upon sensing a loss of cooling airflow, or an exhaust air temperature greater than 300°F.
12. Locate on top of generator enclosure.
13. Load bank shall automatically connect to the generator when the running load is less than 30% and automatically disconnect when the load exceeds 50%.

2.10 OUTDOOR SOUND ATTENUATED WEATHER-PROTECTIVE HOUSING

A. The generator set shall be provided with a factory-installed housing to allow the generator set to operate at full rated load in the ambient conditions previously specified. The enclosure shall reduce the sound level of the generator set while operating at full rated load to an maximum of 73 dBA, which shall be an eight-position average of any location 7 meters from the geometric center point of the generator set in a free field environment. Housing configuration and materials used may be of a suitable design which meets application needs, except that acoustical materials used shall be oil and water resistant. No foam materials shall be used unless they can be demonstrated to have the same durability and life as fiberglass. The acoustical housing shall match the standard footprint of the standard housing-ready generator set base. The enclosure shall include hinged doors for access to both sides of the engine and alternator, and the control equipment. Key-locking and pad lockable door latches shall be provided for all doors. Door hinges shall be stainless steel. The enclosure shall be provided with an exhaust silencer which is mounted inside of the enclosure and allows the generator set package to meet specified sound level requirements. Silencer and exhaust shall include a rain cap and rain shield. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a two-step electro coating paint process, or equal, meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating which meets the following requirements:

1. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
2. Gloss, per ASTM D523, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
3. Crosshatch adhesion, per ASTM D3359, 4B-5B.
4. Impact resistance, per ASTM D2794, 120-160 inch-pounds.
5. Salt spray, per ASTM B117, 1000+ hours.
6. Humidity, per ASTM D2247, 1000+ hours.
7. Water soak, per ASTM D2247, 1000+ hours.

B. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant and designed to minimize marring of the painted surface when removed for normal installation or service work.

C. A 120 VAC heater with thermostat shall be provided within the generator set control panel to eliminate condensation. Contractor shall provide 120 volt, 20 amp circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install generator and housing on a minimum 6 inch high reinforced concrete housekeeping pad. Provide blockouts as required. Bolt the generator to the pad. The pad shall be designed by a structural engineer. Provide working clearances and operational air flow clearances as required by the manufacturer.

B. Provide all power wiring, control wiring, additional contacts and relays required for a complete installation. All conduit shall be in a two-hour enclosure. Underground conduits shall be concrete encased. The wall mounted dual rate battery shall be taken offline during the starting of the generator. The generator belt driven alternator shall charge the batteries when the generator is running.

C. Install generator set and transfer switches in accordance with manufacturer's instructions.

D. The generator shall be installed as a separately derived system. Contractor shall connect the generator neutral to a grounding electrode. Provide a bonding jumper from the ground bar to neutral.

E. Provide engraved plastic nameplates under the provisions of Section 26 02 00.

3.2 WARRANTY

A. The complete standby electric power system, including engine-generator set equipped with set exerciser, and running time meter, shall be warranted for a period of five years from the date of initial start-up. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. This warranty shall be as detailed in available written documents. In the judgement of the specifying authority, the manufacturer supplying the warranty for the complete system must have necessary financial strength and technical expertise with all components supplied to provide adequate warranty support. All items of the engine, generator, and controls that are warranted in the first year shall be covered for the full five-year term of the warranty. Warranty coverage shall include parts, labor, and travel for the full term of the warranty.

B. Extensions of warranty term up to 10 years from start-up and inclusion of comprehensive terms shall be available for one year after start-up.

3.3 TESTS

A. Factory production model tests: Before shipment of the equipment, the generator set shall be tested at an ISO 9001 Certified Facility under rated load and power factor for performance and proper functioning of control and interfacing circuits. Testing at unity power factory only (resistance banks only) is not acceptable, since kW output is affected by the higher generator efficiency at unity power factor, and the kVAR for motor starting and regulation loads is not correlatable between unity and rated power factor. Other tests shall include:

1. Single step load pickup per NFPA 110.
2. Transient response and steady state governing.
3. Safety Shutdowns.
4. Prototype tests in accordance with NFPA 110 level 1 have been done on a complete and functional set. Component level type tests will not substitute for this requirement.

B. The engineer shall be notified in advance of these test and shall have the option of witnessing these tests. Certified copies of test results shall be forwarded to the engineer for review.

C. Field Test After Installation:

1. The complete installation shall be initially started and checked out for operational compliance by factory-trained representative(s) of the engine-generator set and transfer switch manufacturer. The engine lubrication oil and antifreeze, as recommended by the manufacturer for operation under environmental conditions specified, shall be provided by the engine-generator set supplier.
2. Upon completion of initial start-up and system checkout, the supplier of the generator set shall perform a field test, with the engineer notified in advance, to demonstrate load carrying capability, stability, voltage, and frequency. The engineer shall be present during the field test.
3. The generator shall be run for four hours continuously with all available facilities emergency load connected to its output; in addition, the generator set supplier must provide a portable load bank to supplement any existing load to enable full load testing. Load shall not exceed 50% of generator-set rating for first 1/2 hour during first initial run for proper engine break-in. Records shall be maintained throughout this period to record water temperature, oil pressure, ambient air temperature, voltage, current, frequency, kilowatts, and power factor. The above data shall be recorded at 15 minute intervals throughout the test. There shall be a 10 minute unloaded run at the conclusion of the test to allow engine to cool before shutdown. Three copies of the field test data shall be furnished to the engineer. The contractor shall make all necessary hook-ups to accomplish field tests and shall furnish all fuel necessary for field test and start-up.

3.4 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

END OF SECTION

SECTION 26 36 13

MANUAL TRANSFER SWITCH AND DOCKING STATION

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.2 SCOPE

A. Provide a four-pole manual transfer switch and docking station. Refer to drawings for voltage and ampacity. Provide 65,000 A.I.C.

1.3 REQUIREMENTS

A. Level 1 applications are legally-required emergency systems. Level 2 applications are standby systems.

B. The electric generating system must meet all requirements of NFPA 110 including design specification, prototype tests, one-step full-load pickup, and installation acceptance. Engine-generator system to provide source of power for Level 1.

C. Comply with requirements of NFPA 99 as applicable.

D. Comply with requirements of IEEE 446 as applicable.

1.4 REFERENCE STANDARDS

A. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

C. NFPA 70 - National Electrical Code.

D. NFPA 99 - Health Care Facilities Code.

E. NFPA 110 - Standard for Emergency and Standby Power Systems.

F. UL 1008 - Transfer Switch Equipment.

1.5 SUBMITTALS

A. Shop drawings shall include but not be limited to:

1. Catalog cut sheets with all equipment, accessories and devices including all ratings.
2. Complete bill of materials.

B. Operation and Maintenance Data

1. Submit under provisions of Division One.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division One and in accordance with manufacturer's instructions.

B. Accept unit on site on skids. Inspect for damage.

C. 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.

D. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.7 WARRANTY

A. The transfer switch shall be warranted for a period of five years form the date of initial start-up.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide products complying with these specifications and produced by one of the following:

1. ASCO 300 Series
2. Trystar
3. Eaton
4. Russelectric

B. The transfer switch manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center’s personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

2.2 MECHANICALLY HELD TRANSFER SWITCH

A. The transfer switch unit shall be manually operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of three possible positions, Source 1, Source 2, or Center Off. Fused disconnect type switches shall not be acceptable. Provide line side lugs.

B. The switch shall be positively locked and unaffected by momentary outages so that contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.

E. All transfer switches and mechanical operating mechanisms shall be the product of the same manufacturer.

2.3 DOCKING STATION

A. The docking station shall include phase color camlocks with flip covers and mechanical lugs for hard wiring conductors. Each camlock shall be rated at 400 amps and 600 volts. Camlocks colors shall match appropriate voltage indicated in specification Section 26 05 19.

B. Provide the following camlocks and lugs:

C. 400 amps or less – 1 set of camlocks per phase and neutral. Lugs shall be 3/0 thru 600 KCMIL

D. 400A – 1 set per phase/neutral

E. 600A – 2 set per phase/neutral

F. 800A - 2 set per phase/neutral

G. 1000A – 3 set per phase/neutral

H. 1200A – 3 set per phase/neutral

2.4 ENCLOSURE

A. Provide NEMA 1 enclosures for interior and NEMA 3R or NEMA 4X for exterior locations per NEMA 250.

B. Provide Manual Transfer Switch with integral docking station when indicated. Provide double doors to allow access to camlocks and lugs.

C. Provide 120 volt, 125 watt thermostat controlled heat strip with disconnect for outdoor or non-conditioned locations.

2.5 ACCESSORIES

A. Provide Aux contacts to be connected to the permanent generator annunciator.

B. Provide labeling indicating required phase rotation and bonding requirements.

2.6 WITHSTAND AND CLOSING RATINGS

A. The transfer switch shall be UL listed in accordance with UL 1008 and be labeled in accordance with the standard's 3 cycle, long-time ratings. Transfer switches that are not tested and labeled with 3 cycle (any breaker) ratings and have series, or specific breaker ratings only, are not acceptable unless the switch performance is guaranteed and UL listed for molded case circuit breakers or current limiting fuses. If current limiting fuses are utilized, provide current limiting fuses and disconnect switch mounted in or on the transfer switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all power wiring, control wiring, additional contacts and relays required for a complete installation. All conduit shall be in a two hour enclosure. Underground conduits shall be concrete encased.

B. Install in accordance with manufacturer's instructions.

C. Install in accordance with NFPA 70.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Provide engraved plastic nameplates under the provisions of Section 26 02 00.

F. Manual Transfer Switches shall be wall mounted.

G. Docking stations larger than 800 amp shall be mounted on a 6-inch reinforced concrete pad.

H. Combination manual transfer switch and docking stations larger than 800 amp shall be mounted on a 6-inch reinforced concrete pad.

3.2 TESTS

A. Field Test After Installation:

1. The complete installation shall be initially started and checked out for operational compliance by factory-trained representatives of the engine-generator set and transfer switch manufacturer.

3.3 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.

4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration

B. Training

1. Provide training designed for a minimum of four persons, to include:
2. Training in the system operation in all possible configurations.
3. Training in the maintenance of the system.
4. Minimum of four hours of instruction, but sufficient to cover all items specified.
5. Four sets of instruction materials.

END OF SECTION

SECTION 26 41 13.13

LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 GENERAL

A. The General Conditions, Supplementary General Conditions, Division 1 and the Section entitled "Electrical Work - General Requirements" apply to all work herein.

B. Objective: To provide safety for the building and occupants by preventing damage to building structure caused by lightning.

C. Lightning protection coverage shall include all ancillary buildings and structures, including but not limited to fire water tanks, generators and pole mounted light fixtures.

1.2 STANDARDS

A. Comply with these following specifications and standards of the latest issue form a part of this specification:

1. Lightning Protection Institute Installation Standard, LPI-175
2. Underwriters Laboratories, Inc. Installation Requirements, UL 96A
3. National Electrical Code (NEC), NFPA 70
4. National Fire Protection Association Lightning Protection Code, NFPA 780
5. U.S. Bureau of Standards

1.3 SCOPE

A. The work covered in this section of the specifications consists of furnishing all labor, materials, and items of service required for the completion of a functional and unobtrusive lightning protection system as approved by the engineer, and in strict accordance with this section of the specifications and the applicable Contract Drawings. Provide Class I materials for roof levels less than 75 feet and Class II for roof levels 75 feet or greater.

B. If any departure from the Contract Drawings or submittal drawings covered below are deemed necessary by the Contractor, details of such departures and reasons therefore shall be submitted as soon as practical to the engineer for approval.

C. Provide a ground loop using bare #2/0 copper conductor.

1.4 QUALITY ASSURANCE

A. The lightning protection system shall conform to the requirements and standards for lightning protection systems of the LPI, UL, NFPA and NEC. Upon completion, application shall be made to the Underwriters Laboratories, Inc. for inspection and certification.

B. The system to be furnished under this specification shall be the standard product of manufacturers regularly engaged in the production of lightning protection equipment and shall be the manufacturer's latest approved design. The equipment shall be UL listed and properly UL labeled.

1.5 QUALIFIED MANUFACTURERS:

A. Robbins Lightning, Inc.

B. Advanced Lightning Technology

C. Thompson Lightning Protection

D. Harger Lightning Protection

E. East Coast Lightning Equipment

F. nVent ERICO

1.6 SUBMITTALS

A. Complete shop drawings showing the type, size and locations of all grounding, down conductors, through-wall assemblies, roof conductors and air terminals shall be submitted to the engineer for approval.

PART 2 - PRODUCTS

2.1 LIGHTNING PROTECTION EQUIPMENT

A. All materials shall be copper and bronze and of the size, weight and construction to suit the application and used in accordance with LPI, UL, NEC and NFPA. Class I sized components are required for roof levels not exceeding 75 feet in height Class II size components shall be required for roof levels over 75 feet in height. Bolt-type connectors and splicers shall be utilized on Class I and Class II structures. Pressure squeeze clamps are not acceptable. All mounting hardware on the roof shall be stainless steel and on the facade shall be brass and/or copper.

B. Aluminum Components - Aluminum materials may not be used except on roofs that utilize aluminum roofing components. The entire roof lightning protection system shall utilize aluminum components to insure compatibility on aluminum metal roofs or aluminum parapet caps. However, the downleads and grounding shall utilize copper with bimetal transition occurring at the through roof assembly with and approved bimetal through roof assembly. Copper is acceptable as a bimetal transition.

2.2 MATERIALS

A. All equipment used in this installation shall be UL listed and properly UL labeled. All equipment shall be new, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI, UL, NFPA and NEC code requirements.

B. Air terminals shall be nickel-tipped copper, having a copper base. Air terminals shall be spaced not more than twenty feet apart. Provide flathead air terminals on the roof in areas where accidental implement may occur.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation shall be accomplished by an experienced installation company that is UL listed, a member of the Lightning Protection Institute, United Lightning Protection Association qualified, and an employer of Certified Master Installers of lightning protection systems. A Certified Master Installer shall directly supervise the work.

B. All equipment shall be installed in a neat, workmanlike manner. The system shall consist of a complete conductor network at the roof and include air terminals, connectors, splicers, bonds, copper down leads and proper ground terminals.

C. Copper downlead cables shall be utilized.

D. Provide a ground test well at all ground rod locations.

E. Where conductors are run in metal conduit for protection, the conductor shall be bonded to the entrance and exit point of the conduit or approved methods to maintain electrical continuity.

F. Down conductors shall be attached to ground devices in accordance with the specific provisions of the Underwriters' Laboratories, Inc., Code. All-down conductors shall be concealed. Any exposed conductors shall be approved by Architect.

G. All metals of conductance within six feet of the lightning protection system shall be securely bonded and made a part thereof. Where stack or chimney is present, tinned covered non-corrosive air terminals and conductors shall be used. Metal water pipes shall be bonded to the grounding system.

3.2 COORDINATION

A. The lightning protection installer will work with any other trades present to insure a correct, neat and unobtrusive installation.

B. It shall be the responsibility of the lightning protection installer to assure a solid bond to the main water service and to assure interconnection with other ground systems.

3.3 COMPLETION

A. Upon completion of the installation, the lightning protection installer shall secure and deliver to the owner the Underwriters Laboratories, Inc. Master Label certification or the Lightning Protection Institute Certified System certification. The system will not be accepted without the UL Master Label plate or the LPI certification certificate.

END OF SECTION

SECTION 26 43 13.13

SURGE PROTECTIVE DEVICES (SPD) - STANDARD INTERRUPTING

PART 1 - GENERAL

1.1 SCOPE

A. Specify the electrical and mechanical requirements for a non-modular high-energy surge protective device system (SPD). The specified system shall provide effective high energy surge current diversion and be suitable for application in IEEE C62.41.1 Category A, B and C3 environments, as tested by IEEE C62.11, IEEE C62.45.

B. The system shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to +/- 1-volt variance and tested for manufacturer's defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable. Devices shall utilize a minimum of three (3) MOV's fuse links pair per phase. This will allow greater than 50% redundant protection in the event an MOV fails.

C. Third Party Test Report verifying surge current rating, longevity, testing, and filtering capabilities shall be provided with submittal.

1.2 STANDARDS

A. The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

1. Canadian Standards Association (CSA or CUL)
2. American National Standards Institute and
3. Institute of Electrical and Electronic Engineers (IEEE C62.11, IEEE C62.41.1, IEEE C62.41.2 and IEEE C62.45)
4. Institute of Electrical and Electronic Engineers 1100 Emerald Book
5. Federal Information Processing Standards Publication 94 (FIPS PUB 94)
6. National Electrical Manufacturer Association (NEMA LS-1 1992)
7. National Fire Protection Association (NFPA 20, NFPA 70, NFPA 75 and NFPA 780)
8. National Electric Code
9. Underwriters Laboratories (UL 1449 and UL 1283)
10. International Electrotechnical Commission (IEC 801)
11. International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
12. EMC Directive 89/336/EEC - CE compliant

B. The systems individual units shall be UL/ANSI Listed and labeled under UL 1449 (Fourth Edition) Standard for Surge Protection Devices Type 2 20kA with a nominal discharge current of 20kA and the surge ratings shall be permanently affixed to the SPD. The units shall also be listed and labeled to UL 1283 for type 2 locations Standard for Electromagnetic Interference Filters, and CSA/CUL Listed.

1.3 ACCEPTABLE MANUFACTURERS

A. Southern Tier Technologies

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of surge protection devices with ratings, physical dimensions and all accessories clearly labeled.
2. Device labels shall be clearly indicated in cutsheets.
3. All standards and listings, as specified in section 1.2A-B, shall be clearly labeled in cutsheets provided.
4. Cutsheets shall clearly outline that design requirements of this specification have been met.

1.5 QUALITY ASSURANCE

A. The manufacturer shall be ISO 9001 certified. The specified system shall be tested at the component and fully assembled level, under surge conditions with AC power applied for a minimum of 1 hour. Testing shall include but not be limited to quality control checks, dielectric voltage withstand test per UL and CSA requirements, UL ground continuity tests and operational and calibration tests.

B. The unit shall be designed and manufactured in the USA by a qualified manufacturer of surge protection equipment and Active Tracking Filters. The manufacturer shall have been engaged in the design and manufacture of such products for a minimum of 10 years.

PART 2 - PRODUCTS

2.1 ENCLOSURE

A. The specified system shall be provided in a heavy duty NEMA 4 or better dust-tight, drip-tight enclosure with no ventilation openings.

2.2 OVERCURRENT PROTECTION (FUSING)

A. Individual surge components shall be fused to prevent violent failure. The fusing shall be UL listed and shall be capable of interrupting up to 200kA symmetrical fault current with 480VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable. Devices that utilize a single fuse to protect two or more suppression paths are not accepted.

2.3 DESIGN REQUIREMENTS

A. Protection Modes:

1. The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable) Note: L = Line, G = Ground, N = Neutral

B. UL 1449 Ratings:

1. The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following in any mode of protection:

System Voltage	Voltage Protection Rating			
	L-N	L-L	N-G	L-L
120/208	600-volts	700-volts	700-volts	1200-volts

C. Noise Attenuation:

1. The unit shall be UL 1283 Listed as an electromagnetic interference filter in type 2 locations. The filter shall provide insertion loss with a maximum of 60 dB from 100 KHz to 100 MHz per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120 dB insertion loss from 100 KHz to 100 MHz when used in a coordinated facility system.

D. Life Cycle Testing:

1. The SPD system shall be duty life cycle tested to survive 6,000 20kV, 10kA Surges, per IEEE C62.41.1 Category C3 surge current with less than 5% degradation of clamping voltage.

2.4 CONNECTIONS

A. Provide 60” wire leads #10 AWG or UL 1449 tested size.

2.5 STANDARD FEATURES

A. Unit Status Indicators:

1. Red and green solid state indicators with printed labels shall be provided on the front cover to redundantly indicate on-line unit status including N-G monitoring. The absence of the green light and the presence of the red light shall reliably indicate that surge protection is reduced and service is needed to restore full operation.

B. Dry Contacts for remote monitoring:

1. Electrically isolated Form C dry contacts, one normally open and one normally closed set standard on all units for remote monitoring.

C. Undervoltage detection:

1. Unit shall be equipped with 70% undervoltage detection capability.

D. Phase Loss Monitoring:

1. Unit shall be equipped with phase loss monitoring.

E. Power Loss Monitoring:

1. Unit shall be equipped with power loss monitoring.

2.6 TESTING

A. Component Testing and Monitoring:

1. Unit shall include an on-line circuit which tests and redundantly monitors individual components in all protection modes including neutral to ground (where applicable). Units that require external test sets or equipment are not acceptable.

2.7 ENVIRONMENTAL REQUIREMENTS

A. Storage Temperature: -55 to +85 C (-67 to +187 F)

B. Operating Temperature: -40 to +60 C (-40 to 140 F)

C. Relative Humidity: 0% to 95%

D. Audible Noise: less than 45 dBa at 5 feet (1.5 m).

E. Operating Altitude: 0 to 18,000 feet above sea level.

2.8 WARRANTY

A. The manufacturer shall provide a full 10-year parts and a 5-year labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct, factory trained, ISO 9001 certified employees must be available for 48-hour assessment. A 24-hour 800 number must be available to support the warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the parallel SPD with short and straight conductors as practically possible. Locate adjacent to the switchboard or panel it is serving. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes. Provide STT TierGuide cable if the cable length exceeds 5 feet from the circuit breaker servicing the SPD.

B. Provide Flush Mount Stainless Steel Cover Kit for kitchen areas.

C. Provide Flush Mount Cover Kit for residential units and hotel suites.

END OF SECTION

SECTION 26 43 13

SURGE PROTECTIVE DEVICE (SPD) - SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SCOPE

A. Provide electrical and mechanical requirements for a modular high-energy surge protective device system (SPD). The system shall provide effective high energy surge current diversion and be suitable for application in IEEE C62.41.1 Category A, B and C3 environments, as tested by IEEE C62.11, IEEE C62.45.

B. The system shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to +/- 1-volt variance and tested for manufacturer's defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable. Device shall utilize a minimum of three (3) MOV's fuse link pair per phase. This will allow redundant protection in the event an MOV fails.

C. Third Party Test Report verifying surge current rating, longevity, testing, and filtering capabilities shall be provided with submittal.

1.2 STANDARDS

A. The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

1. Canadian Standards Association (CSA or CUL)
2. American National Standards Institute and
3. Institute of Electrical and Electronic Engineers (IEEE C62.11, IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45)
4. Institute of Electrical and Electronic Engineers 1100 Emerald Book
5. Federal Information Processing Standards Publication 94 (FIPS PUB 94)
6. National Electrical Manufacturer Association (NEMA LS-1 1992)
7. National Fire Protection Association (NFPA 20, NFPA 75 and NFPA 780)
8. National Electric Code (NFPA 70)
9. Underwriters Laboratories (UL 1449 and UL 1283)
10. International Electrotechnical Commission (IEC 801)
11. International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
12. EMC Directive 89/336/EEC - CE compliant

B. The systems individual units shall be UL/ANSI Listed and labeled under UL 1449 (Fourth Edition) Standard for Surge Protection Device type 1 nominal discharge current of 20kA and the surge ratings shall be permanently affixed to the SPD. The units shall also be listed and CSA or CUL Listed.

1.3 ACCEPTABLE MANUFACTURERS

A. Southern Tier Technologies

1.4 SUBMITTALS

A. Shop drawings shall include, but not be limited to:

1. Cutsheets of surge protection devices with ratings, physical dimensions and all accessories clearly labeled.
2. Device labels shall be clearly indicated in cutsheets.
3. All standards and listings, as specified in section 1.2A-B, shall be clearly labeled in cutsheets provided.
4. Cutsheets shall clearly outline that design requirements of this specification have been met.

1.5 QUALITY ASSURANCE

A. The manufacturer shall be ISO 9001 certified. The specified system shall be tested at the component and fully assembled level, under surge conditions with AC power applied for a minimum of 1 hour. Testing shall include but not be limited to quality control checks, dielectric voltage withstand test per UL and CSA requirements, UL ground continuity tests and operational and calibration tests.

B. The unit shall be designed and manufactured in the USA by a qualified manufacturer of line conditioning equipment and Active Tracking Filters. The manufacturer shall have been engaged in the design and manufacture of such products for a minimum of 10 years.

PART 2 - PRODUCTS

2.1 ENCLOSURE

A. The specified system shall be provided in a heavy duty NEMA 4 or better dust-tight, drip-tight enclosure with no ventilation openings. The cover of the enclosure shall be hinged on the left side and require a tool for access to internal components. A drawing pocket shall be provided inside the door for storage of unit drawings and installation/operation manual. All monitoring indication must be visible without opening the door. The enclosure maximum dimensions shall be (16) inches/(406) millimeters high, (16) inches/(406) millimeters wide and (8) inches/(203) millimeters deep.

2.2 OVERCURRENT PROTECTION (FUSING)

A. Individual surge components shall be fused to prevent violent failure. The fusing shall be UL listed and shall be capable of interrupting up to 200kA symmetrical fault current with 480VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable. Devices that utilize a single fuse to protect two or more suppression paths are not accepted.

2.3 DESIGN REQUIREMENTS

A. Protection Modes:

1. The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable) Note: L = Line, G = Ground, N = Neutral

B. UL 1449 Ratings:

1. The maximum UL/ANSI 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following:

System Voltage	Voltage Protection Rating			
	L-N	L-G	N-G	L-L
120/208	700-volts	700-volts	700-volts	1200-volts

C. Noise Attenuation:

1. The unit shall be UL 1283 Listed as an electromagnetic interference filter for type 2 locations. The filter shall provide 41dB at 100kHz, 31dB at 1MHz, 35dB at 10MHz, 53dB at 100MHz, per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120-dB insertion loss from 100 kHz to 100 MHz when used in a coordinated facility system.

D. Life Cycle Testing:

1. The SPD system shall be duty life cycle tested to survive, 10kA (8x20µs), 20kV (1.2x50µs), IEEE C62.41.1 Category C surge current with less than 5% degradation of clamping voltage. The minimum numbers of surges the unit shall be able to protect against are:

Model Surge Rating	Number of Life Cycle Surges			
	Per Mode			*Per Phase*
	L-N	L-G	N-G	L-N + L-G
250kA per phase	12000	12000	12000	24000
500kA per phase	24000	24000	24000	48000

2.4 CONNECTIONS

A. The terminals shall be provided to accommodate wire sizes up to #1/0 AWG.

2.5 INTERNAL CONNECTIONS AND SERVICEABILITY

A. All surge current diversion module intra-unit connections shall be by way of low impedance copper. Surge current diversion modules shall use bolted connections to the plates for reliable, low impedance connections. The system shall be designed for simple change out of any or all SPD component modules by a qualified electrician. Designs that require factory service are not acceptable. All connections, conductors and terminals must be appropriately sized for specified surge current capacity.

2.6 STANDARD FEATURES

A. Component Testing and Monitoring:

1. The monitoring circuitry must continually verify the protection status during operation, and display this information on the front cover status panel. The SPD must also contain a built-in-test circuit that will verify the integrity of all fuse links and each associated MOV. The built-in-test circuit must cycle through all phase banks and the neutral-ground bank sending test signals to all modules including N-G. The integrity of all fuses in test must be indicted on the status panel. All testing must be able to be performed without disconnecting power to the SPD. Units that require external test sets or equipment are unacceptable.

B. Unit Status Indicators:

1. Red and green solid state indicators with printed labels shall be provided on the hinged front cover to redundantly indicate on-line unit status. The absence of the green light and the presence of the red light shall reliably indicate that surge protection is reduced and service is needed to restore full operation.

C. Surge Counter:

1. Provide up to 7-digit LED/LCD surge counter to total transient voltage surges.

D. Dry Contacts for remote monitoring:

1. Electrically isolated Form C dry contacts, one normally open and one normally closed set standard on all units for remote monitoring.

E. Undervoltage detection:

1. Unit shall be equipped with 70% undervoltage detection capability.

F. Phase Loss Monitoring:

1. Unit shall be equipped with phase loss monitoring.

G. Power Loss Monitoring:

1. Unit shall be equipped with power loss monitoring.

2.7 ENVIRONMENTAL REQUIREMENTS

A. Storage Temperature: -55 to +85 C (-67 to +187 F)

B. Operating Temperature: -40 to +60 C (-40 to 140 F)

C. Relative Humidity: 0% to 95%

D. Audible Noise: less than 45 dBa at 5 feet (1 5 m)

E. Operating Altitude: 0 to 18,000 feet above sea level

2.8 WARRANTY

A. The manufacturer shall provide a full 10-year parts and 5 year on site labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct, factory trained, ISO 9001 certified employees must be available for 48-hour assessment. A 24-hour 800 number must be available to support warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The contractor shall install the parallel SPD with short and straight conductors as practically possible. Locate adjacent to the switchboard or panel it is serving. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes. Provide STT TierGuide cable low impedance cable when long lead lengths are needed.

END OF SECTION

SECTION 26 51 19

LIGHTING FIXTURES

PART 1 - GENERAL

1.1 SCOPE

A. Provide general and emergency lighting fixtures as noted on the drawings. Fixtures shall be completely wired with lamps installed and shall be in perfect operating condition at the time of substantial completion.

B. The types of lighting fixtures required for this project include:

1. LED

1.2 STANDARDS

A. All fixtures shall conform to all applicable UL standards and shall be UL label including damp and wet location ratings. “ETL listed” is an acceptable listing.

B. NFPA 101

C. ANSI C82.1

D. NEMA-LE

E. All LED drivers shall be UL recognized Class 2 per UL1310 or non-Class 2 per UL 1012 as applicable.

F. All LED drivers shall comply with applicable requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, for Non-Consumer Equipment.

G. All LED drivers shall be RoHS compliant.

H. TM-21

I. LM-80

J. LM-79

K. L70

L. DLC

M. UL 1008

1.3 ACCEPTABLE MANUFACTURERS

A. Provide lighting fixtures produced by manufacturers as shown and scheduled.

B. LED DRIVER:

1. Provide one of the following manufacturers
   a. Eldo
   b. Lutron
   c. Osram
   d. Philips

C. LAMPS:

1. Provide one of the following LED Chip manufacturers
   a. Cree
   b. Nichia
   c. North American Philips
   d. Seoul
   e. Lumileds

1.4 SUBMITTALS

A. Shop drawings shall include a brochure with a separate cut sheet for each fixture type arranged in alphabetical order with fixture and all accessories/options clearly labeled. Provide performance data for each fixture. Provide an independent test lab report for each fixture if requested by the Architect/Engineer.

B. Provide driver and LED module data brochures for each fixture type.

C. Provide air handling and heat removal data for light fixtures specified with these requirements.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.
3. UL fire resistance directory.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General:

1. Provide the size, type and rating of each light fixture shown and scheduled. All light fixtures shall complete with reflectors, lens, trim rings, flanges, LED modules, lamp holders, drivers, fuses, wiring, earthquake clips, etc. to provide a complete functioning light fixture.

B. Lighting Fixture Types:

1. LED Fixtures

a. Fixtures shall be pre-wired with frame-in kit and integral thermal management system for fixtures. Driver shall be encased in metal-can construction for optimal thermal performance.
b. Total fixture lumen output is dependent on the chip, thermal management, driver current and optical system. LED fixtures shall be tested as a complete unit or system. Only DOE recognized CALiPER testing laboratory results shall be utilized.
c. Interior LED fixtures shall have integral common mode and differential mode surge protection of 3kV(1.2/50µs, 2 ohm combination wave).
d. Exterior LED fixtures shall have integral common mode and differential mode surge protection of 10kV/10kA(1.2/50µs, 2 ohm combination wave).

2. Exit signs
a. Exit signs shall meet all federal, state and local codes.
b. Provide fire alarm interface relay when required to flash exit signs.
c. Provide battery packs for emergency operation when not connected to emergency generator power.

2.2 LED MODULES AND DRIVERS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. LED

1. Driver manufacturer shall have a 10-year history producing electronic drivers for the North American market.
2. Driver shall carry a five year limited warranty from date of manufacture against defects in material or workmanship (including replacement) for operation at a maximum case temperature of 80 degrees Celsius.
3. Drivers shall not contain any Polychlorinated Biphenyl (PCB).
4. Provide driver with integral color-coded leads.
5. Driver shall operate from 50/60 Hz input source of 120 Volt through 277 Volt or 347 Volt through 480 Volt with sustained variations of +/- 10% (voltage) with no damage to the driver.
6. Driver output shall be regulated to +/- 5% across published load range. And shall have a power factor greater than .90 for primary application to 50% of full load rating with an input current Total Harmonic Distortion (THD) of less than 20% to 50% of full load rating.
7. Provide drivers with a Class A sound rating.
8. Provide LED drivers for outdoor fixtures with a minimum operating temperature of -40 degrees Celsius (-40 F). Provide LED drivers for indoor fixtures with a minimum operating temperature of -20 degrees Celsius (-2F).
9. Drivers shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
10. Driver output ripple current shall be less than 15% measured peak-to-average, with ripple frequency being greater than 100Hz.
11. Driver performance requirements shall be met when operated to 50% of full load rating.
12. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.
13. Drivers shall comply with NEMA 410 for in-rush current limits.
14. Dimmable drivers shall be controlled by a Class 2 low voltage 0-10VDC controller with dimming range controlled between 1 and 8VDC with source current 150µA.

2.3 LAMPS – COORDINATE WITH LIGHT FIXTURE SCHEDULE

A. LED Lamps shall be appropriately matched to the driver with junction-down design for improved thermal management. Maximum DC Forward Current.

2.4 EMERGENCY LED BATTERY BACKUP

A. Provide Bodine #BSL310M for emergency light fixtures in 9 or 10-foot ceiling.

B. Provide Bodine #BSL20 for emergency LED driver for emergency light fixtures in ceiling heights greater than 12 feet.

C. Provide Bodine #BSL17-C2 for emergency LED driver for LED downlights.

D. Provide unswitched hot leg. Hot leg shall originate from the same branch circuit as required in NEC article 700.12 (F).

2.5 POLES

A. Provide poles for area lighting fixtures as specified. Poles shall be one piece, anchor base, with 2-piece steel bolt cover and vibration dampers. Poles shall be round straight steel as specified on the Lighting Fixture Schedule.

B. Provide all poles with appropriate mounting accessories including arms, tenons, or bullhorns as required. Anchor bolts shall be hot dipped galvanized, sized as required by the manufacturer of the pole.

C. All poles shall have a normal 3” x 5” hand hole at 18” above the base flange and grounding provision.

D. Poles shall be prime painted interior and exterior. The exterior shall be finished with polyester powder coating and architectural finish as specified by the Architect. The interior with 3 mil thermoplastic hydrocarbon resin, or equivalent to meet 1000-hour salt spray exposure (ASTM B-117).

PART 3 - EXECUTION

3.1 INSTALLATIONS

A. General

1. Install the type of lighting fixture where shown and indicated in accordance with manufacturer's written instructions.
2. Provide earthquake clips on all recessed lay-in lighting fixtures as required by building code.
3. Adjust all adjustable lighting fixtures, as directed by the Architect.
4. Provide safety chains and wire guards for lighting fixtures located in gymnasium, multi-purpose rooms, play areas, etc.

B. Coordination

1. The contractor shall verify the type of fixtures with the ceiling types as indicated on the drawings. Any discrepancies shall immediately be brought to the architect's attention before the contractor places his order and accepts delivery. Fixtures shall fit exact in the type of ceiling scheduled. Provide plaster frames, trim rings and other accessories required for a correct fit.
2. Provide supports attached to structural member to support fixtures when the ceiling system cannot maintain support. Provide separate supports for all recessed ceiling mounted HID fixtures.
3. Refer to architectural reflected ceiling plan for the exact location of all lighting fixtures. Notify the architect for any discrepancies or conflicts with structural, architectural, mechanical piping or ductwork before installation.

C. Mounting

1. Provide support channels to support outlet boxes used support surface mounted lighting fixtures such as exit signs or downlights.
2. Pendant or surface mounted fixture shall be provided with required mounting devices and accessories, including hickeys and stud-extensions, ball-aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with mechanical contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on the drawings or established in the field. The allowable variation tolerance in mounting individual fixtures shall not exceed 1/4 inch and shall not vary more than 1/2 inch from the floor mounting height shown on the Drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Fixtures shall employ single - not twin - stem hangers unless otherwise noted.
3. All structure mounted fixtures (i.e. bracket mounted, pipe mounted and surface mounted) shall be provided with cables of suitable size and weight to support the weight of the fixture. Cables shall be fastened around or fastened to the housing of the fixture. On pendant fixtures, one safety cable of suitable size and weight to support the weight of the fixture assembly shall connect the top of the pendant to the supporting structure by means of welding or bolting, and one safety cable shall connect the housing of the fixture to the bottom of the pendant. Where more than one pendant per fixture occurs, only one pendant must be cabled. Track fixtures for pendant mounted track shall also be supplied with clip-on safety cables of suitable size and weight to support the weight of the fixture.
4. Provide secondary support wires from all four (4) corners of the lay-in fixtures to the structure above. Do not support fixtures from ceiling grid wire supports, piping, conduit, side walls, or mechanical equipment. Ceiling specifications do not supersede this requirement.
5. Where pole mounted luminaries are provided, provide appropriate anchor base pole as specified with manufacturer’s recommended anchor bolts. Verify exact location on site for poles with Architect, Civil, and Landscape documents. Poles shall be installed on proper footing. Refer to details on the drawings. Provide grounding connection to a separately driven ground rod, outside of the footing. Where indicated provide pole with identification plate indicating pole number.

D. Electrical Connection

1. All light fixtures shall be connected from a branch circuit junction box using 1/2" flexible metal conduit or MC cable fixture pigtails not exceeding 8'- 0". Provide #12 AWG conductors. All fixtures must be grounded by using a grounding conductor. Fixture to fixture wiring of fixtures installed in accessible ceiling is not permitted. Fixture whips shall not lay-on ceiling tile or grid. Provide caddy clips to provide additional support.

3.2 FINAL INSPECTION

A. Remove all plastic and protective coating from all fixtures. Fixtures shall be thoroughly cleaned. Replace any damaged fixture or fixture parts including reflectors, louvers, lens and metal parts that show signs of corrosion.

B. Replace all other defective fixtures showing signs of excessive usage.

C. Demonstrate proper operation of all fixtures and controls. Refer to other sections and details on the drawings for lighting controls.

END OF SECTION

SECTION 28 05 00

BASIC MATERIALS AND METHODS FOR FIRE ALARM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B. The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons, therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.

1.2 SCOPE OF WORK

A. The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B. This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C. The approximate locations of Electrical items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E. All discrepancies within the Contract Documents discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F. It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G. It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each, and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H. The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I. Contractor shall participate in the commissioning process; including but not limited to meeting attendance, completion of checklists and participation in functional testing.

J. Refer to 26 03 13 for demolitions requirements.

1.3 RELATED SECTIONS

A. General Conditions

B. Supplementary Conditions

C. Division One

1.4 COOPERATION WITH TRADES

A. Cooperation with trades of adjacent, related, or affected materials or operations shall be considered a part of this work in order to affect timely and accurate placing of work and bring together in proper and correct sequence, the work of such trades.

1.5 REFERENCES

A. National Electrical Code (NEC)

B. American Society for Testing and Materials (ASTM)

C. Underwriter's Laboratories, Inc. (UL)

D. Insulated Cable Engineer's Association (ICEA)

E. National Electrical Manufacturer's Association (NEMA)

F. Institute of Electrical and Electronics' Engineers (IEEE)

G. American National Standards Institute (ANSI)

H. National Fire Protection Association (NFPA)

I. International Energy Conservation Code (IECC)

1.6 COMPLETE FUNCTIONING OF WORK

A. All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B. Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.

1. Approximate location of transformers, feeders, branch circuits, outlets, lighting and power panels, outlets for special systems, etc., are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such outlets, conduit runs, etc., and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.
2. Communicate with the Architect and secure his approval of any outlet (light fixture, receptacle, switch, etc.) location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific approval, shall be removed and relocated when so directed by the Architect. Location of light fixtures shall be coordinated with reflected ceiling plans.

C. Additional coordination with mechanical contractor may be required to allow adequate clearances of mechanical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.7 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.8 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:

a. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.

b. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.

c. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. Onsite supervision, journeyman shall have minimum of journeyman license. Helpers, apprentices shall have minimum of apprentice license.

1.9 DATE OF FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B. The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.10 DEFINITIONS AND SYMBOLS

A. General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B. Definitions and explanations of this Section are not necessarily either complete or exclusive but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C. Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D. Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E. Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F. Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G. Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H. Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I. Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J. Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K. Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances) or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L. Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by ASHRAE Fundamentals Handbook, chapter 39 "Abbreviations and Symbols", ASME and ASPE published standards.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C. Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.12 SUBMITTALS

A. Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.
2. An index page with a listing of all data included in the Submittal.
3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.
4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.
5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.
6. Identification of each item of material or equipment matching that indicated on the Drawings.

7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.
8. Additional information as required in other Sections of this Division.
9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B. Refer to Division 1 for additional information on shop drawings and submittals.

C. Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D. Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E. Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.
2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.
3. and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.
4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.
5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.

6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F. Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G. Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H. Furnish detailed shop drawings, descriptive literature, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:

1. Fire Alarm System
2. Intrusion System

I. Refer to each specification section for additional requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.14 COORDINATION DRAWINGS

A. Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
   a. Wall and type locations.
   b. Clearances for installing and maintaining insulation.
   c. Locations of light fixtures and sprinkler heads.
   d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
   e. Equipment connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Routing of storm and sanitary sewer piping.
   h. Fire-rated wall and floor penetrations.
   i. Sizes and location of required concrete pads and bases.
   j. Valve stem movement.
   k. Structural floor, wall and roof opening sizes and details.
2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.
3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B. This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DRAWINGS

A. Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 26 and Division 28.

B. The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C. The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D. Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

E. If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

F. The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS
DATE:
(NAME OF GENERAL CONTRACTOR)
BY:_____
(SIGNATURE)
(NAME OF SUBCONTRACTOR)
BY:_____
(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A. Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B. Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C. Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D. Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 26.

1.17 MAINTENANCE MANUALS

A. Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in "D ring type" binders by National model no. 79-883 or equal, binders shall be large enough to allow ¼" of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Electrical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 26 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 26 and Division 2, include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Reviewed shop drawing submittals with exceptions noted compliance letter.
3. Fabrication drawings.
4. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
5. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
6. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
7. Equipment name plate data.
8. Wiring diagrams.
9. Exploded parts views and parts lists for all equipment and devices.
10. Color coding charts for all painted equipment and conduit.
11. Location and listing of all spare parts and special keys and tools furnished to the Owner.
12. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C. Refer to Division 1 for additional information on Operating and Maintenance Manuals.

D. Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.18 OPERATOR TRAINING

A. The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C. Refer to other Division 26 Sections for additional Operator Training requirements.

1.19 SITE VISITATION

A. Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B. Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C. Understand the existing utilities from which services will be supplied; verify locations of utility services and determine requirements for connections.

D. Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.20 WARRANTY

A. The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

B. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, freight/shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service call required to diagnose warranty problems.

1.21 TRANSFER OF ELECTRONIC FILES

A. Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B. Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C. When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D. Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E. The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.
2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.
3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:

1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.
2. Alternate equipment must be equal from the standpoint of materials, construction and performance.
3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B. The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.2 UL LISTING

A. All materials and products used on this project shall be listed by Underwriters' Laboratories.

2.3 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:

1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.4 ESCUTCHEONS

A. Provide heavy chrome or nickel plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.5 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.6 PAINTING

A. All factory assembled equipment for electrical work, except light fixtures, that normally is delivered with a factory applied finish shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

2.7 RACEWAY IDENTIFICATION

A. Conduit Systems: Provide adequate marking of major conduit which is exposed or concealed in accessible spaces to distinguish each run as either a power or signal/communication conduit. Use red banding with black lettering except as otherwise indicated. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, on pull boxes, on junction boxes and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction and at spacings of not more than 50 feet along each run of conduit.

B. Underground Cable Identification: Bury a continuous, preprinted, bright colored plastic ribbon cable marker with each underground cable (or group of cables), regardless of whether conductors are in conduit, duct bank, or direct buried. Locate each directly over cables, 6 to 8 inches below finished grade.

C. Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way.
2. Prohibited Markings: Markings which are intended to identify the manufacturer, vendor, or other source from which the material has been obtained are prohibited for installation within public, tenant, or common areas within the project. Also, prohibited are materials or devices which bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters' Laboratories, Inc.), and approval labels are exceptions to this requirement.

3. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.
4. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical system, provide tags of plasticized card stock, either preprinted or hand printed.

PART 3 - EXECUTION

3.1 EXCAVATING AND BACKFILLING

A. Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3" of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. All work shall comply with OSHA Standards.

3.2 WORKMANSHIP AND CONCEALMENT

A. The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of electrical work shall be concealed in walls, chases, under floors and above ceilings except:

1. Where shown to be exposed.
2. Where exposure is necessary to the proper function.

3.3 SLEEVES, CUTTING AND PATCHING

A. This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O-Z/Gedney.

B. All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

C. All un-used sleeves shall be sealed with 2 hour UL approved fire sealant manufactured by "3M" or approved equal.

D. Refer to 26 05 33 for additional requirements.

3.4 CONTROL PANELS

A. Install all Panels in accordance with the National Electrical Code, industry standards and as shown on the drawings.

B. Panels mounted in telecom, MDF, IDF, mechanical/electrical rooms shall be mounted at a working height not requiring a ladder when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices (note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

3.5 CLEANING

A. Touch-up and refinish scratches and marred surfaces on panels.

3.6 CORROSIVE AREAS

A. In areas of a corrosive nature, which include but are not limited to the following: pool equipment rooms, cooling towers and areas subject to salt air, etc., provide NEMA 4X stainless steel or fiberglass reinforced enclosures for contactors, panel boards, controllers, starters, disconnects and materials used as supporting means (i.e. plastibond unistrut, pipe, fittings). The use of spray on coating may be acceptable in some applications.

3.7 TESTS AND INSPECTIONS

A. Tests and inspection requirements shall be coordinated with Division 01.

B. Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C. Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D. Put equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E. Final Inspection

1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.
2. Panels shall be cleaned and in operating condition.
3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.

4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.
5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

END OF SECTION

SECTION 28 46 00

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. The contractor shall provide a complete microprocessor based 24VDC, electrically supervised, analog intelligent fire alarm system as specified herein and indicated on the drawings. The system shall include, but not be limited to, all control equipment, power supplies, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.

B. All equipment, materials, accessories, devices, etc. covered by the specifications and/or noted on the contract drawings shall be new and unused and be U.L. listed for their intended use.

C. The system shall operate as a non-coded, continuous sounding system which will sound alarm devices until manually silenced, as herein specified.

D. Authority Having Jurisdiction shall dictate the system wiring Class (A or B) supervised system for all circuits.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ICC (IBC) - International Building Code.

C. NFPA 70 - National Electrical Code.

D. NFPA 72 - National Fire Alarm and Signaling Code.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

F. NFPA 101 - Life Safety Code.

G. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.

H. UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems.

I. UL 228 - Safety Door Closers-Holders, with or without Integral Smoke Detectors.

J. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems.

K. UL 268A - Standard for Smoke Detectors for Duct Application.

L. UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories.

M. UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems.

N. UL 864 - Control Units and Accessories for Fire Alarm Systems.

O. UL 1638 - Standard for Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories.

P. UL 1971 - Standard for Signaling Devices for the Hearing Impaired.

Q. UL 2034 - Standard for Single and Multiple Station Carbon Monoxide Alarms.

R. UL 2075 - Standard for Gas and Vapor Detectors and Sensors.

1.3 INSTALLING CONTRACTOR'S RESPONSIBILITY

A. The installing fire alarm contractor is responsible for the design of a code compliant system, which meets the intent of all State and Local Authority Having Jurisdiction Codes and their adopted amendments along all permitting of such plans and associated permit fees. Reference and coordinate with all contract specifications and plans.

1.4 ACCEPTABLE MANUFACTURERS

A. Provide one of the following manufacturers:

1. Silent Knight Farenhyt IFP 2100 Series (Basis of Design)

B. Alternate Manufacturers

1. Equipment from other manufacturer's or supplier's may be considered as an equal to that specified provided that completely marked and identified catalog sheets of all proposed equipment is provided to the architect/engineer for review ten (10) days prior to the date of bid for evaluation. In addition, a list of the contractor's qualifications and any exceptions to the specifications must be provided for review. Approval for any such substitution of equipment must be obtained in writing from the architect/engineer for five (5) days prior to bid.

1.5 GENERAL REQUIREMENTS

A. Contractor Qualifications:

1. The equipment supplier shall be an authorized and designated representative of the Fire Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment.
2. The equipment supplier and installing contractor shall be licensed by the State Fire Marshal to sell, install, and service fire alarm systems as required by Article 5.43-2 of the State Insurance Code.

3. The installing contractor and/or equipment supplier shall have on his staff a minimum of three (3) installation superintendents who are licensed by the State Fire Marshal's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the State insurance code.
4. The installing contractor or equipment supplier shall have on staff a minimum of one (1) certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place.
5. The installing contractor shall provide 24 hour, 365 days per year emergency service with qualified and state licensed service technicians.
6. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems for at least ten (10) years.

1.6 SUBMITTALS

A. The installing contractor and/or equipment manufacturer shall provide complete and detailed shop drawings and include:

1. Control panel configuration including wiring and interconnection schematics.
2. Complete point to point wiring diagram showing terminal connections to all system devices.
3. Riser wiring diagram and associated zoning/addressing configurations with associated conduit sizes.
4. Complete floor plan drawings in a PDF format shall locate all devices associated with the fire alarm system. Floor plan drawings shall include conduit and wiring routing complete with conduit sizing and number of conductors by type.
5. Factory data sheets on each piece of equipment to be used and so marked as to model, dimensions, size, voltage, and configuration.
6. Detailed system description in this specification format describing system functions and operation. All specification variations and deviations shall be clearly noted and marked.
7. Complete Bill of Material for reference.
8. Programming matrix defining all input/output functions and zoning.
9. Power supply and battery calculations.
10. A written certification from the manufacturer stating that the fire alarm system contractor is authorized to sell, service and install the submitted equipment.

B. Submittal shall include documentation confirming all qualifications have been met. Submittals without qualification documentation shall be returned "Revise and Resubmit".

C. All submittal data shall include the contractor's name, supplier's name, project name, and state fire alarm license number adequately identified.

1.7 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all trades including, but, not exclusive of: elevator, electrical contractor, sprinkler contractor, and HVAC/controls contractor and intercom system. Adequate coordination shall be provided to insure proper installation and interface to all peripheral items required to interact with the fire alarm and communication system to provide a complete and functional life safety system.

PART 2 – PRODUCTS

2.1 SYSTEM FUNCTIONAL OPERATION

A. Alarm Detection

1. When a fire alarm condition is detected by any of the system alarm initiating devices, the following functions shall occur:
   a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledgment or silencing the alarm condition shall silence the alarm signals and cause flashing alarm LED's to illuminate steady.
   b. A multi-character back-lit LCD display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
   c. Any remote or local annunciator LED's associated with the alarm zone shall be illuminated as herein specified.
   d. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
   e. Activate all audible and visual alarm notification devices throughout the facility.
   f. De-activate HVAC systems over 2,000 CFM.
   g. Display system status changes on the remote annunciators.
   h. Release all smoke doors, fire doors, fire coiling doors, fire smoke dampers and fire shutters.

System Trouble Detection

2. When a trouble condition is detected by the CPU, one of the system initiating, alarm or SLC circuits, the following functions shall immediately occur:
   a. The system trouble LED on the CPU module shall flash and the internal audible trouble device shall sound. Acknowledgment of the trouble condition shall silence the audible trouble device and cause all trouble LED's to illuminate steady.
   b. The multi-character alphanumeric LCD annunciator shall display all applicable information via the alphanumeric display associated with the respective trouble condition and its location.
   c. The system common trouble indicator on associated remote annunciators shall be illuminated as specified herein.

B. Auxiliary Control

1. All designated "non-silenceable" auxiliary control functions shall remain in operation (even upon silencing of audible alarms) until such time as the control panel is cleared and reset manually (i.e. fan control outputs, central station interface, elevator recall interface, etc.).
2. Activation of duct smoke detectors associated fans shall shutdown their respective units immediately in addition to identifying the condition as herein specified. Duct detectors shall be programmed as a supervisory condition per NFPA 72.

C. System Supervisory Detection

1. When a supervisory condition is detected by the fire alarm control panel, the following functions shall occur:
   a. The fire alarm control panel supervisory indicator shall flash and the internal audible device shall sound Acknowledgment of the supervisory condition shall silence the audible device and cause the supervisory indicator to illuminate steady
   b. The multi-character liquid crystal display shall display all applicable information associated with the respective supervisory condition.
   c. Display the system status change on the remote annunciators

D. Remote Off-site Monitoring

1. The remote off-site monitoring system shall transmit point specific alarm, trouble and supervisory signals to an Approved Central Supervising Station (Central Station connection, phone lines or cellular connectivity service provided by Owner).

E. Fire Drill Control

1. Provide a fire drill switch located on the Fire Alarm Control Panel. When activated, this switch will activate all horns and visual devices (strobes) for a fire drill. It shall not release fire shutter, shut down air handling equipment or recall elevators. If a fire alarm condition is detected, the system shall operate as defined in part A - "Alarm Detection" of this section.

2.2 ZONING

A. The system shall have the inherent capability to employ "Intelligent" smoke detectors and addressable interface devices capable of being recognized and annunciated at the main control panel on an individual basis. All zoning/device location information shall be totally field programmable to exact job requirements as approved by the Architect/Engineer.

2.3 FIRE ALARM CONTROL PANEL

A. The fire alarm control panel shall be provided with adequate number of SLC points to serve the building plus 50% spare. The control panel shall utilize DISTRIBUTED solid state MICROPROCESSORS. The microprocessor based CPU shall be completely FIELD PROGRAMMABLE. CPU module shall provide for programmable non-volatile EEPROM memory. All circuitry shall be U.L. listed for power-limited application. System shall be sized to accommodate the capacity of the system specified and shown on the drawings. System shall be capable of being networked for future expansion.

Central Processing Unit Module (CPU)

1. The CPU shall contain and execute all custom time control functions or control-by-event programs for specified events including 'Holiday' exceptions. Time control event/programs shall be automatically overridden by priority fire alarm events. All programs shall be held in non-volatile programmable memory, and shall not be lost if both system primary and secondary power failure occurs.

2. System CPU shall also provide for non-alarm points for non-fire, low priority building functions. The CPU shall provide capability of multi-stage signaling, tornado warning, emergency radio communication enhancement system, positive alarm sequencing as well as remote control system operation.

B. Display Interface Assembly (DIA)

1. The DIA shall provide a multi-character backlit, supertwist Liquid Crystal Display (LCD). It shall provide Light-Emitting Diodes (LED's) for AC POWER; SYSTEM ALARM; SYSTEM TROUBLE; SUPERVISORY; CPU FAIL; and ALARM SILENCED.
2. The display shall provide power to a 25-key membrane keypad with control capability to command all system functions, status readouts, manual control action, and entry of any alphanumeric or numeric information. The keypad shall include means to enter multiple five digit passwords to prevent unauthorized manual control programming.

C. Control Switches

1. Acknowledge/step Switch
2. Signal Silence Switch
3. System Reset Switch
4. System Test Switch
5. Lamp Test

D. System Outputs

1. The system shall provide the following outputs:
   a. One port for lap top and/or modem
   b. One port for supervised remote LCD annunciators (RS-485)

E. Loop Interface (SLC)

1. The CPU shall communicate and provide power to all devices on its loop over a single pair of wires. The CPU shall receive digital/ANALOG information from all "intelligent" detectors and shall process this information to determine normal, alarm, trouble, and sensitivity conditions. The analog information may be used for automatic test and determination of maintenance requirements, and be U.L. listed for such use. The CPU module shall individually monitor all "intelligent" detectors for sensitivity variation initiating a trouble condition should detector sensitivity "drift" become excessive. The system control unit shall have the capability to remotely read each detector's sensitivity in % obscuration, and if need be, electronically adjust the detector sensitivity as required for existing conditions within U.L. recommended limits. In addition, the system shall incorporate a "day/night" sensitivity feature. The system shall provide capability to program each individual detector for multiple 'pre-alarm' conditions. Each 'pre-alarm' level shall be field programmable as a function of the programmed alarm level. The system shall allow designated control-by-event actions to occur as may be required prior to any sensor reaching the designated alarm point.

F. Non-Lock Walk Test

1. The system shall include a special non-lock "walk test" mode. The walk test mode shall incorporate a time-out feature to return system to normal. Test results shall be capable of being generated and displayed on the LCD annunciator.

G. Automatic Detector Test

1. The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. An automatic detector test shall occur automatically a minimum of every two hour period or be initiated manually from the FACP as desired. Automatic detector test sequencing shall be terminated upon receipt of a true alarm condition.

H. Special System Reports

1. The system shall have the ability to generate and print, upon command, system and point status reports. Selection of 'system' read status provides the operator with global system programming information as well as providing the operator with all individual point programming data. The system shall also provide the capability to print out a detailed 'history' report from system history file upon command.

I. Field Programming

1. The system shall be 100% field programmable without the need for external computers or, PROM programmers, and shall NOT require replacement of memory IC's. All programs shall be stored in non-volatile EEPROM memory. Programming shall be accomplished only after entering an appropriate and pre-selected five digit password security code. System programming mode shall NOT require the system to be taken off-line nor prohibit the system from performing its normal operations and routines. The system shall be capable of revising/changing programmed functions or system expansion at any time subsequent to initialization as described herein without factory modifications or factory programming. Field programming via the use of external computers may be considered provided programming can be accomplished on-site and the owner is permanently furnished with the required programming apparatus and software as part of this contract.

J. Event History

1. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via five digit password security code.

K. Power Supply

1. The power supply shall provide all control panel and peripheral power needs with filtered power as well as rectified 24VDC power for external audio-visual devices. All power supplies shall be designated to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits.
2. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide both positive and negative ground fault supervision, battery/charger fail condition, A.C. power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
3. Batteries shall have 24 hours of standby capacity and 5 minutes of alarm capacity. Battery charger shall recharge batteries from full discharge to full charge over a 24-hour period. Switching from normal power to battery power and back shall occur automatically.

2.4 FIELD DEVICES

A. Multi Criteria Smoke Detector (Smoke and Heat)

1. Provide intelligent multi detector. The intelligent multi criteria detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in micro processor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen, etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes)
3. The intelligent multi criteria detection devices shall included the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chamber and comparing them to a database of actual fire and deceptive phenomena.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.

B. Intelligent Duct Detector

1. Provide duct mounted “intelligent” photoelectric smoke detectors shall be provided per applicable codes. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type “intelligent” smoke sensors. The unit shall be capable of interchanging/accepting either photo-electronic or ionization type sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the use of zone modules.

2. The unit shall consist of a clear molded plastic enclosure with integral conduit knockouts. The unit shall be provided with clear faceplate cover to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination. Detectors shall be installed per NFPA 90A, and be listed with the fire alarm control panel. A remote LED shall be located on the corridor ceiling adjacent to the respective detector where detectors are not plainly visible or concealed from view.

C. Intelligent Thermal Detectors

1. Provide analog, fixed temperature thermal detectors shall be provided where indicated on the drawings. The detectors shall use dual electronic thermostats to measure temperature levels in the chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
2. The detectors shall provide dual alarm and power/status LED's. Status LED's shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also provided in the base to connect an external remote alarm LED.
3. The detectors shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.

D. Conventional Weatherproof Thermal Detector

1. Provide heat detection devices when located in harsh and/or moist environments, such as showers and similar areas, which are subject to high humidity, the following device shall be provided. Weatherproof Heat Detector 135°F Rate Compensated shall be provided. The detector shall mount in a weatherproof 4" electrical box with 1/2" NPT threaded hub. This detector shall be connected to an addressable monitor module.

E. Addressable Manual Pull Stations

1. Manual stations shall be provided where indicated on the drawings.
   a. The manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel.
   b. All manual pull stations shall be considered of durable molded polycarbonate material and shall be RED in color with raised white lettering. Stations be the dual action type.
   c. All manual pull stations shall be provided with an STI-1100 series clear plastic cover with integral horn.

F. Monitor Module

1. Provide addressable monitor modules where required to interface to contact alarm devices. The monitor module shall be used to connect a supervised zone of conventional initiating devices to an intelligent SLC loop.

G. Control Module

1. Provide control and relay modules where required to provide audible alarm interface and/or relay control interface. The control module shall be used to connect a supervised zone of conventional indicating devices to an intelligent loop. The zone may be wired class A or class B - field selected. The control module may be optionally wired as dry contact (form C) relay.
2. The control module shall be addressable. A status LED shall be provided which shall flash under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED shall illuminate steady when the device is actuated via the fire alarm control panel.

H. Electronic Audio Visual Devices

1. Audible/Visual alarm devices shall be electronic horn/strobe units. Devices shall be wall or ceiling mounted. Devices shall be provided with the ability to provide multiple candela settings. Units shall operate at 24VDC and be polarized supervised. Each unit shall provide a choice of three difference audible tones capable of being field selected. Preferred alarm signal shall be a temporal tone producing a sound pressure level of 84 dBA. The visual device shall use Xenon strobe type producing a minimum of 15 candela on a 24 VDC limited energy supervised circuit and meet the requirements of ADA and local codes. Strobe unit shall automatically flash upon operation of the horn. Horn/strobe unit shall be provided in textured white finish and be flush mounted. All visual devices shall be synchronized.

I. Electronic Alarm Horn

1. Provide solid state electronic alarm devices where indicated on the contract drawings. Units shall operate at 24 VDC and be polarized supervised. Each unit shall provide a choice of three different audible tones capable of being field selected. Preferred alarm signal shall be a temporal tone producing a sound pressure level of 84 dBA.
2. Units shall be flush mounted and molded of high-impact white plastic.

J. Exterior Audio Visual Devices

1. All audio visual devices located outside or labeled weatherproof shall be weatherproof.
2. All devices shall be provided with a weather proof type back box.

K. High Intensity Visual Signals

1. Provide visual signal device. High intensity visual signals shall be installed where shown on the drawings and as may be required by the Americans with Disabilities Act (Public Law 101-336) and local codes. High intensity visual alarms shall be Xenon strobe type producing a minimum of 15 candela on a 24 VDC limited energy supervised circuit. Alarm devices shall be designated to be wall or ceiling mounted as indicated on the drawings. Signals shall operate in unison with audible alarm appliances. All visual devices shall be synchronized. Units shall be flush mounted and shall be provided in textured white.

L. Sprinkler Waterflow Switch

1. Sprinkler water flow switches shall be installed where indicated on the drawings. Each unit shall contain one set of SPDT alarm contacts. Water flow switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor.

M. Sprinkler Valve Supervisory Switch

1. Sprinkler valve supervisory switches shall be installed on each valve as indicated on the drawings. Each unit shall contain on set of SPDT contacts. Sprinkler valve supervisory switches shall be provided, installed, and adjusted by the fire protection contractor, and connected by the fire alarm contractor.

N. Auxiliary Air Handling Unit (AHU) Relays

1. Relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy duty type and rated up to 10 amps at 24 VDC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with SPDT contacts as well as (fail safe) so that if the cable is broken, disconnected etc., the AHU will automatically shutdown.

O. Field Charging Power Supplies

1. Provide power supplies with battery backup as required. Provide 120 volts dedicated circuit to each power supply.

P. Remote LCD Alpha-Numeric Annunciators

1. Provide remote LCD alpha-numeric annunciator to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator shall be a backlit eighty-character LCD display and operate via the system RS485 and RS232 serial output terminal from main FACP. The LCD display shall automatically illuminate upon receipt of an alarm or trouble condition. The luminary source shall extinguish during normal/standby model to conserve power. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote LCD annunciator shall include:
   a. Integral time-date clock
   b. Time-date select clock
   c. Time-date/contrast adjust
   d. Display/step switch
   e. System reset
   f. System silence
   g. System acknowledge
   h. Integral trouble buzzer
2. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The unit shall be equipped with an integral lamp test feature. The unit shall be semi flush mounted where shown.

Q. Protective Covers

1. Provide protective covers on all wall mounted fire alarm devices located in student restrooms, corridors and in the cafeteria. These protective covers shall be manufactured by Safety Technology International, Inc. (STI). These covers shall be provided on all devices including but not limited to smoke detectors, heat detectors, audible and visual devices, pull stations, etc. The mounting of a device shall be reinforced to enable the protective covers to protect the fire alarm devices.

R. Multi Criteria Fire/Carbon Monoxide (CO) Detector (FCO-951) for sleeping rooms

1. Multi criteria acclimating detector shall be provided where shown on the drawings. The intelligent multi criteria detector shall be an addressable device that is designed to monitor a minimum of photoelectric, flame, thermal and CO technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings.
2. The detector design shall allow for a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
3. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
4. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the flame, thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.
5. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base with integral sounder.
6. Provide integral low frequency sounder base for smoke detection and 4-code temporal sound for CO detection.

S. Smoke Alarms for Dwelling Units

1. The combination photoelectric smoke and carbon monoxide alarm shall be a Gentex Model GN-503/GN-503F/GN-503FF or approved equal which shall provide at least the following features and functions:
   a. The smoke alarm portion of device shall utilize an infrared LED sensing circuit which pulses in 4 to 5 second intervals when subjected to smoke. After 2 consecutive pulses in smoke, the alarm shall activate.
   b. The CO alarm shall utilize an electrochemical sensing element with a minimum 5-year life.
   c. The carbon monoxide alarm portion of device is adjusted not to detect CO levels below 30 PPM and will not alarm when exposed to constant levels of 30 PPM for 30 days. Per UL 2034 requirements, the device will alarm at the following levels: 70 PPM CO between 1 to 4 hours, but not less than 1 hour. 150 PPM CO between 10 to 50 minutes. 400 PPM between 4 to 15 minutes.
   d. The GN-503 Series device shall have a 9VDC alkaline battery as a back-up in the event building power is lost.

e. The alarm shall provide an indicator when the battery is low in power, high impedance or is missing.
f. The CO alarm will provide an audible indicator of 3 quick chirps every 30 seconds at end of life of CO sensor.
g. The alarm shall include a solid state red color LED that will indicate presence of CO at the unit.
h. The audible alarm shall include a solid state piezo alarm rated at 85dBA at 10ft.
i. A visual LED monitor (condition indicator) shall slow pulse in normal operation and rapid pulse in alarm (red color)
j. An easily accessible test button shall be provided. Push down on button for 5 seconds causing smoke/CO alarm to activate.
k. The device shall have tandem interconnect capability of up to 12 smoke/CO alarms.
l. The GN-503FF alarm shall have the capability to tandem interconnect with all Gentex tandem capable smoke alarms, CO alarms or combination smoke/CO alarms.
m. The manufacturer shall provide models with the optional feature of auxiliary Form A/Form C relay contacts for initiating remote functions and annunciation and a relay option that is capable of activation by tandem interconnect wire.
n. The combination smoke/CO alarm shall be non-latching (self-restoring).

2. Power and Interconnection Requirements
a. Provide 120 VAC primary power from building wiring served from a commercial source.
b. Provide interconnecting tandem wiring between smoke/CO alarms so that the activation of one alarm will activate all of the alarms in the individual unit.

PART 3 - EXECUTION

3.1 DESIGN CRITERIA

A. The contractor shall provide drawings for Owner, Engineer and Fire Marshal's approval.

B. Drawings shall be prepared by a state licensed alarm planning superintendent.

C. Drawings shall comply with all local, state and federal code. These include but are not limited to NEC, UL, NFPA, etc.

D. Locate the fire alarm control panel in main telecommunications / MDF room unless otherwise directed by the owner.

E. Locate a remote annunciator in the main lobby area unless otherwise directed by the owner.

F. Provide additional items required above minimum codes include the following:

1. Manual pull stations shall be located not more than 5 feet from the entrance to each exit. Additional manual stations shall be located so that the travel distance to the nearest manual station does not exceed 200 feet. Provide Stopper II covers on all manual pull stations
2. Manual pull station heights shall be a minimum of 42" and a maximum of 48" measured vertically, from the finished floor level to the activating handle or lever.
3. Smoke Detectors – Paths of egress, electrical rooms, mechanical rooms, MDF, IDF, elevator lobby, storage rooms, top of stairs, elevator machine room, top of elevator shaft, above each fire alarm panel and remote power supplies terminal cabinets. Smoke detectors shall also be provided in each room/area that can be occupied by kindergarten and pre-kindergarten children, which shall include cafeteria, gymnasiums, daycares, libraries, classrooms and similar areas.
4. Duct type smoke detectors – all air handling units over 2,000 CFM in duct work or return air paths.
5. Heat Detectors – Shops, kitchens, coffee bars, central plants, boiler room, garages, truck bays and other non conditioned areas when detection is required..
6. Flow switches – Sprinkler riser.
7. Horns - throughout the building.
8. Strobes – throughout the building.
9. Remote Power supplies: Locate in mechanical rooms, electrical rooms, MDF or other areas approved by Owner.
10. Smoke Detectors with low frequency sounder bases inside and outside all sleeping rooms. Do not locate over bed.
11. Monitor Fire Pump.
12. System Carbon Monoxide Detectors - Provide one in each sleeping room, kitchen, and the first room of each mechanical system where gas furnaces are serving spaces. Combination CO and smoke detector may be utilized in sleeping rooms. Provide CO detection in locations where gas water heaters are provided. Locate near the door; do not locate over the bed.
13. Tamper Switches- Sprinkler riser and vaults located on the site.

3.2 INSTALLATION

A. Wiring

1. All wiring shall be in accordance with NFPA 72 and NFPA 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
2. All wire shall be plenum rated, U.L. Listed, limited energy (300 volt) FPLP or MPP wire and shall be run open in return air ceiling plenums. The wire shall comply with NFPA 262 for such applications, shall be of the low smoke producing fluorocarbon type and shall comply with NEC Article 760 if so approved by the local authority having jurisdiction. Provide conduit in all inaccessible locations, inside concealed wall, all mechanical/electrical rooms, or other areas where wiring might be exposed and subject to damage.

3. Support wire clear of knock out panels, access panels, and maintenance spaces for equipment. Wire and cable shall be run using wire management techniques supporting cable as close as possible to within one foot of the floor or roof rafters. Wire supports shall be directly fastened to the structure on a maximum of five foot centers. Wire routing shall be parallel and perpendicular to building lines. The wire and cable shall be secured with tie wraps or carrier wire. Sagging in excess of three inches will not be allowed nor will bending of the supporting ring structure.
4. All wiring for SLC signaling circuits shall be of the twisted low capacitance type to guard against outside RF and EMF interference and induced noise.
5. All wiring shall be run in a supervised fashion (i.e. no branch wiring or dog-legged wiring) per NFPA requirements such that any wiring disarrangement will initiate the appropriate trouble signals via the main control panel per NFPA.
6. Wiring splices shall be kept to a minimum with required splices to be made in designated terminal boxes or at field device junction boxes. Transposing or color code changes of wiring will not be permitted. End-of-line supervisory devices shall be installed with the last device on the respective circuit. Devices shall be appropriately marked designating it as the terminating device on the respective circuit.
7. No A.C. wiring or any other wiring shall be run in the same conduit as fire alarm wiring.
8. All insulation on conductors shall be RED with traces to identify circuits.

B. Open Wiring

1. Systems utilizing open wiring techniques with low smoke plenum cable.
2. Support wire clear of knock out panels access panels and maintenance spaces for equipment. Wire and cable shall be run using wire management techniques supporting cable as close as possible to within one foot of the floor or roof rafters. Wire supports shall be directly fastened to the structure on a maximum of five foot on centers. Wire routing shall be parallel and perpendicular to building lines. The wire and cable shall be secured with tie wraps or carrier wire. Sagging in excess of three inches will not be allowed nor will bending of the supporting ring structure.
3. Provide Caddy J-hooks supported independently from other system to support cable at 4-foot on center or closer if required by manufacturer.
4. Provide a junction box to make up all joints and splices.
5. Provide cable supports in all vertical raceways in accordance with Article 300-19 of NFPA 70.

C. Conduit/Raceway

1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified in division 26 specifications and per National Electrical Code.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

5. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

D. Minimum Wire Sizes Shall Be As Follows:

1. Signaling Line Circuit: 18 AWG
2. Notification Appliance Circuit: 14 AWG
3. Relay Control Circuits: 18 AWG

E. Sprinkler Valves

1. Contractor shall connect all tamper switches and post indicator valves to the supervisory circuit. Connect all water flow switches to the alarm circuit. Coordinate exact locations of water vaults valves and flow switches with sprinkler contractor.

3.3 NOTIFICATION APPLIANCE CIRCUITS SYNCHRONIZATION

A. All visual and audible devices shall be synchronized per the current state adopted version of NFPA 72. Provide all components required.

3.4 SMOKE AND COMBINATION FIRE SMOKE DAMPERS

A. Provide duct type smoke detectors in ductwork downstream of each smoke damper and fire smoke damper. Locate within 5 feet on the damper. Provide a remote smoke detector reset device. Provide access panel when not located above an accessible ceiling. Interlock with HVAC unit serving the ductwork to shut down.

3.5 MISCELLANEOUS SYSTEMS

A. Monitor all fire suppression systems, carbon monoxide system panels and refrigerant system control panels.

3.6 TEST AND REPORTS

A. A state licensed factory trained technical representative of the manufacturer shall perform the final control panel connections and supervise testing of the system and it shall be subject to the approval of the responsible engineer and owner. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

B. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. In addition, each circuit in the system shall be fully tested for wiring supervision to insure proper wiring installation. Any items found not properly installed or non-functioning shall be replaced or repaired and re-tested. All testing shall be supervised by a licensed fire alarm superintendent.

C. The installing contractor shall provide a complete written report on the functional test of the entire system. The test and report shall verify the function of each device in the system, operation of all auxiliary control functions, and the proper operation of the main fire alarm control panel. A copy of the test report shall be provided with maintenance manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout.

D. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction.

3.7 SPARE PARTS AND ATTIC STOCK

A. Provide 5% spare field devices including labor to install them. Devices not used shall be given to the Owner at completion of the job.

B. The fire alarm contractor shall include in his bid the cost to provide and install the additional spare parts and attic stock and associated cabling as indicated on the schedule on the contract drawings. All devices on this schedule not used during construction shall be turned over to the owner at the time of job completion.

3.8 WARRANTY

A. The fire alarm system shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy, whichever shall occur first. Any equipment shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner.

3.9 GRAPHIC FLOOR PLANS

A. Provide 1/16” = 1’-0” floor plan showing all devices and zoning. Zoning shall correspond to the zone on the fire alarm control panel. The floor plans shall be framed with a glass cover and located by the fire alarm control panel. This graphic floor plan shall use the actual room numbers based on the architectural graphics package. Verify specific requirements with Owner. Provide a sample for approval.

END OF SECTION