

**Tuffli Company
Phase 1 – Spec Building**

3652 N 1150 W
Spanish Fork, Utah 84660

PROJECT MANUAL



TUFFLI
C O M P A N Y

ISSUED FOR BUILDING PERMIT

June 05, 2026

Owner
Tuffli Company

Architect
Antunovich Associates

General Contractor
T.B.D.

Civil Engineer
Atlas Engineering

Structural Engineer
raSmith

MEP and FP Engineer
CJL Engineering

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SECTION 003100 - AVAILABLE PROJECT INFORMATION

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Property survey.
 - 2. Geotechnical report.
- B. Related Requirements:
 - 1. Concealed Conditions: General and Supplementary Conditions.

1.02 EXISTING CONDITIONS

- A. General:
 - 1. Certain information relating to existing surface and subsurface conditions and structures is available to Bidders for information only, and are not a warranty of existing conditions. The Owner and the Architect do not guarantee the accuracy or validity of the data, nor do they assume any responsibility for the Bidder's interpretation of the data.
 - 2. This Document and its attachments are not part of the Contract Documents.
 - 3. Information provided is for Bidders' convenience and is intended to supplement rather than serve in lieu of Bidders' own investigations. Verify data and existing conditions. At Bidder's option, perform additional investigations at own expense.
- B. Property Survey: A site survey has been made by Atlas Engineering.
 - 1. Survey is included with the Drawings.
- C. Geotechnical Report: A geotechnical report has been made based on borings made at the site by GSH Geotechnical, Inc., and is entitled Report Geotechnical Study Proposed Spanish Fork Project Approximately 800 West 4000 South Spanish Fork, Utah and is dated August 20, 2024.

A Letter – Addendum No. 1 regarding lateral pressures and subgrade modulus was issued by GSH Geotechnical, Inc and dated April 24, 2026.
 - 1. Geotechnical Report and Project Memorandum are included as an attachment to this Section.

1.03 PRODUCTS (NOT USED)

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END OF SECTION

**REPORT
GEOTECHNICAL STUDY
PROPOSED SPANISH FORK PROJECT
APPROXIMATELY 800 WEST 4000 SOUTH
SPANISH FORK, UTAH**

Submitted To:

Turner Group
18 West Lawrence Street, Suite 100
Pontiac, Michigan 48352

Submitted By:

GSH Geotechnical, Inc.
473 West 4800 South
Salt Lake City, Utah 84123

August 20, 2024

Job No. 3898-001-24

August 20, 2024
Job No. 3898-001-24

Mr. Jay S. Turner
Turner Group
18 West Lawrence Street, Suite 100
Pontiac, Michigan 48352

Mr. Turner:

Re: Report
Geotechnical Study
Proposed Spanish Fork Project
Approximately 800 West 4000 South
Spanish Fork, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical study performed at the site of the proposed Spanish Fork Project to be located at approximately 800 West 4000 South in Spanish Fork, Utah. GSH previously completed a geotechnical study for the site dated April 26, 2023¹. The general location of the site with respect to existing roadways, as of 2024, is presented on Figure 1, Vicinity Map. A more detailed layout of the site showing proposed facilities, existing roadways, as well as the borings drilled and test pits excavated in conjunction with this study is presented on Figure 2, Site Plan.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of the study were planned in discussions between Mr. Jay S. Turner of Turner Group and Mr. Robert Gifford of GSH Geotechnical, Inc. (GSH).

¹ "Geotechnical Study, Proposed Spanish Fork South Office/Warehouse/Data Center, Approximately 800 West 4000 South, Spanish Fork, Utah" prepared by GSH Geotechnical, Inc., GSH Job No. 3621-004-23.

In general, the objectives of this study were to:

1. Define and evaluate the subsurface soil and groundwater conditions across the site.
2. Provide appropriate foundation, earthwork, pavement, and geoseismic recommendations to be utilized in the design and construction of the proposed facilities.

In accomplishing these objectives, our scope has included the following:

1. A field program consisting of the exploration, logging, and sampling of 15 borings and 10 test pits.
2. A laboratory testing program.
3. An office program consisting of the correlation of available data, engineering analysis, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of the Professional Services Agreement No. 24-0457 dated April 23, 2024.

1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration borings and test pits, projected groundwater conditions, and the layout and design data discussed in Section 2, Proposed Construction. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, GSH must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings developed, and our recommendations prepared in accordance with generally accepted engineering principles and practices in this area at this time.

2. PROPOSED CONSTRUCTION

The project is to consist of the construction of one (1) or more office/warehouse/distribution structures and associated pavements. The structures are anticipated to be 1- to 2-stories of tilt-up concrete or CMU construction, to be placed slab-on-grade, and supported upon conventional spread and continuous wall footings.

Maximum real column and wall loads are anticipated to be on the order of up to 220 kips and 5 to 6 kips per lineal foot, respectively. Real loads are defined as the total of all dead plus frequently applied (reduced) live loads.

Paved parking areas, light- and heavy-duty drive lanes, and loading/unloading areas are planned around the structures. Projected traffic in the parking areas is anticipated to consist of a light volume of automobiles and light trucks, occasional medium-weight trucks, and no heavyweight trucks. Proposed traffic in the light-duty drive lanes is anticipated to consist of a moderate volume of automobiles and light trucks, a light volume of medium-weight trucks, and occasional heavyweight trucks. Projected traffic in the heavy-duty drive lanes and loading/unloading areas is anticipated to consist of a moderate volume of automobiles, light trucks, and medium-weight trucks with a light volume of heavyweight trucks.

Site development will require some earthwork in the form of minor cutting and filling. At this time, we anticipate that maximum site grading cuts and fills, excluding utilities, will be on the order of 1 to 3 feet.

3. SITE INVESTIGATIONS

3.1 GENERAL

Subsurface conditions in unexplored locations or at other times may vary from those encountered at specific boring and test pit locations. If such variations are noted during construction or if project development plans are changed, GSH must review the changes and amend our recommendations, if necessary.

Boring and test pit locations were established by estimating distances and angles from site landmarks. If increased accuracy is desired by the client, we recommend that the boring and test pit locations and elevations be surveyed.

3.2 FIELD PROGRAM

To define and evaluate the subsurface soil and groundwater conditions across the site, 15 borings and 10 test pits were completed within the accessible areas. These borings and test pits were completed to depths ranging from 3.0 to 46.5 feet with a truck-mounted drill rig equipped with hollow-stem augers and a moderate-sized rubber track-mounted excavator. The approximate locations of the borings and test pits are presented on Figure 2.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the drilling operations, a continuous log of the subsurface conditions encountered was maintained. In addition, samples of the typical soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications were supplemented by subsequent inspection and testing in our laboratory. Graphical

representation of the subsurface conditions encountered is presented on Figures 3A through 3O, Boring Logs and Figures 4A through 4H, Test Pit Logs. Soils were classified in accordance with the nomenclature described on Figure 5, Key to Boring Log and Figure 6, Key to Test Pit Log (USCS).

A 3.25-inch outside diameter, 2.42-inch inside diameter (Dames & Moore), a 2.0-inch outside diameter, 1.38-inch inside diameter drive sampler (SPT), and a 2.42-inch inside diameter thin-wall drive sampler were utilized at select locations and depths within the borings and test pits to collect soil samples for further examination and laboratory testing. The blow counts recorded on the boring logs were those required to drive the sampler 12 inches with a 140-pound hammer dropping 30 inches.

Following completion of exploration operations, 1.25-inch diameter slotted PVC pipe was installed in a majority of the borings to provide a means of monitoring the groundwater fluctuations. The borings and test pits were then backfilled. Although an effort was made to compact the backfill, it was not placed in uniform lifts and compacted to a specific density. Consequently, settlement of the backfill with time is likely to occur.

3.3 LABORATORY TESTING

3.3.1 General

To provide data necessary for our engineering analysis, a laboratory testing program was performed. This program included moisture, density, partial gradation, Atterberg limits, consolidation, laboratory vane shear, and chemical tests. The following paragraphs describe the tests and summarize the test data.

3.3.2 Moisture and Density Tests

To provide index parameters and to correlate other test data, moisture and density tests were performed on selected samples. The results of these tests are presented on the boring logs, Figures 3A through 3O.

3.3.3 Partial Gradation Tests

To aid in classifying the granular soils, partial gradation tests were performed. Results of the tests are tabulated below and presented on the boring logs, Figures 3A through 3O:

Boring/ Test Pit No.	Depth (feet)	Percent Passing No. 200 Sieve	Moisture Content Percent	Soil Classification
B-11	15.0	73.8	31.8	CL
B-14	15.0	66.9	35.1	CL

3.3.4 Atterberg Limits Test

To aid in classifying the soils, Atterberg limits test was performed on representative samples of the fine-grained cohesive soils. Results of the test are tabulated below and presented on the boring logs, Figures 3A through 3O:

Boring No.	Depth (feet)	Liquid Limit (percent)	Plastic Limit (percent)	Plasticity Index (percent)	Soil Classification
B-1	5.0	33	20	13	CL
B-1	40	37	18	19	CL

3.3.5 Consolidation Tests

To provide data necessary for our settlement analysis, consolidation testing was performed on 8 representative samples of the natural fine-grained clay soils encountered at the site. The results of these tests indicate that the samples tested slightly over-consolidated and will exhibit low to moderate strength and moderate to high compressibility characteristics under the anticipated loading. Detailed results of the tests are maintained within our files and can be transmitted to you, upon your request.

3.3.6 Laboratory Vane Shear Tests

To determine the undrained shear strength of the clay soils encountered at the site, laboratory vane shear tests were performed. The results of the tests are tabulated below:

Boring No.	Depth (feet)	Soil Type	In-Situ Moisture Content (percent)	Dry Density (pcf)	Ultimate Shear Strength (psf)
B-2	10.0	CL	26.6	93.7	5,425
B-4	2.5	CL	32.3	86.6	1,090
B-6	7.5	CL	30.4	94.7	1,000
B-7	5.0	CL	27.8	91.0	825

3.3.7 Chemical Tests

To determine if the site soils will react detrimentally with concrete, chemical tests were performed on a representative sample of the near-surface soil encountered at the site. The results of the chemical tests are tabulated on the following page.

Boring No.	Depth (feet)	Soil Classification	pH	Total Water-Soluble Sulfate (mg/kg-dry)
B-1	2.5	CL	8.5	206

4. SITE CONDITIONS

4.1 SURFACE

The site is located at approximately 800 West 4000 South in Spanish Fork, Utah. The majority of the site is currently vacant/undeveloped land with a single-family residential structure in the southwest corner of the site. The northwest portion of the site was utilized as a staging ground for a construction site directly adjacent to the east and subsequent fill was placed in this location. The southern portion was previously utilized as agricultural fields. The topography of the site is relatively flat, grading down to the northeast with a total relief of approximately 4 to 6 feet. Site vegetation consists of various weeds and grass in the southern portion of the site.

The site is bounded to the north by 4000 South Street followed by vacant/undeveloped land; to the east by an active construction site; to the south by commercial structures and vacant/undeveloped land; and to the west by 800 West Street followed by vacant/undeveloped land.

4.2 SUBSURFACE SOIL

The following paragraphs provide generalized descriptions of the subsurface profiles and soil conditions encountered within the borings and test pits conducted during this study. As previously noted, soil conditions may vary in unexplored locations.

The borings and test pits were completed to depths ranging from 3.0 to 46.5 feet. The soil conditions encountered in each of the borings and test pits, to the depths completed, were generally similar across the boring and test pit locations.

- Approximately 4 to 8 inches of topsoil was encountered in Borings B-1 through B-10 as well as Test Pits TP-1, TP-2, TP-4 through TP-7, TP-9, and TP-10. Topsoil thickness is frequently erratic and thicker zones of topsoil shall be anticipated.
- Non-engineered fill soils were encountered in each boring and test pit except Borings B-3, B-4, B-6 through B-9, and B-12 to depths ranging from 1.0 to 6.0 feet beneath the existing ground surface. The non-engineered fill soils primarily consisted of clay with varying silt, sand, and gravel content.
- Natural soils were encountered below the non-engineered fill or the ground surface in each boring and test pit. The natural soils consisted primarily of clay with varying silt, sand, and gravel content.

The natural clay soils were soft to hard, moist to saturated, gray, dark brown, and brown in color, and moderately over-consolidated. The natural clay soils are anticipated to exhibit moderate strength and compressibility characteristics under the anticipated loading.

For a more descriptive interpretation of subsurface conditions, please refer to Figures 3A through 3O, Boring Logs and Figures 4A through 4H, Test Pit Logs. The lines designating the interface between soil types on the boring logs and test pit logs generally represent approximate boundaries. In situ, the transition between soil types may be gradual.

4.3 GROUNDWATER

On April 5, 2023 (following original drilling), groundwater was measured within the PVC pipes installed as tabulated below:

Boring No.	Groundwater Depth (feet)
	April 5, 2023
B-1	3.1
B-2	3.9
B-6	5.1
B-7	4.6
B-10	5.7

On August 6, 2024 (following additional drilling), groundwater was measured within the PVC pipes installed as tabulated below:

Boring No.	Groundwater Depth (feet)
	August 6, 2024
B-11	Pipe Damaged
B-12	Pipe Damaged
B-13	Pipe Damaged
B-14	5.5
B-15	Pipe Damaged

Groundwater levels vary with changes in season and rainfall, construction activity, irrigation, snow melt, surface water run-off, and other site-specific factors.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

The proposed structures may be supported upon conventional spread and continuous wall foundations supported upon suitable natural soils and/or structural fill extending to suitable natural soils.

The most significant geotechnical aspects at the site are:

1. The existing non-engineered fills across much of the site.
2. The relatively shallow depth to groundwater.

Prior to proceeding with construction, removal of any existing debris, surface vegetation, root systems, topsoil, non-engineered fill, and any deleterious materials from beneath an area extending out at least 5 feet from the perimeter of the proposed structure footprints and 3 feet beyond pavements and exterior flatwork areas will be required. All existing utility locations shall be reviewed to assess their impact on the proposed construction and abandoned and/or relocated as appropriate.

Due to the developed nature of this site and the surrounding area, additional non-engineered fills may exist in unexplored areas of the site. Based on our experience, non-engineered fills are frequently erratic in composition and consistency. All surficial loose/disturbed soils and non-engineered fills must be removed below all footings, floor slabs, and pavements.

Groundwater was measured as shallow as 3.1 feet below the ground surface. GSH recommends placing floor slabs no closer than 4 feet from the highest groundwater elevation. Site grading fill may be utilized to raise the overall grade to achieve the required separation between the floor slab and the highest groundwater elevation.

Proof rolling of the natural clay subgrade must not be completed if cuts extend to within 1 foot of the groundwater surface. In areas where cuts are to extend to within 1 foot of the groundwater surface, stabilization must be anticipated.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

Detailed discussions pertaining to earthwork, foundations, pavements, and the geoseismic setting of the site are presented in the following sections.

5.2 EARTHWORK

5.2.1 Site Preparation

Initial site preparation will consist of the removal of any existing debris, non-engineered fills, surface vegetation, root systems, topsoil, and any deleterious materials from beneath an area extending out at least 5 feet from the perimeter of the proposed structure footprint and 3 feet beyond pavements and exterior flatwork areas. All existing utility locations shall be reviewed to assess their impact on the proposed construction and abandoned and/or relocated as appropriate.

It must be noted that from a handling and compaction standpoint, soils containing high amounts of fines (silts and clays) are inherently more difficult to rework and are very sensitive to changes in moisture content, requiring very close moisture control during placement and compaction. This will be very difficult, if not impossible, during wet and cold periods of the year. Additionally, the on-site soils are likely above optimum moisture content for compacting at present and would require some drying prior to re-compacting.

Subsequent to stripping and prior to the placement of floor slabs, foundations, structural site grading fills, exterior flatwork, and pavements, the exposed subgrade must be proof rolled by passing moderate-weight rubber tire-mounted construction equipment over the surface at least twice. If excessively soft or otherwise unsuitable soils are encountered beneath footings, they must be completely removed. If removal depth required is greater than 2 feet below footings, GSH must be notified to provide further recommendations. In pavement, floor slab, and outside flatwork areas, unsuitable natural soils shall be removed to a maximum depth of 2 feet and replaced with compacted granular structural fill.

Subgrade preparation as described must be completed prior to placing overlying structural site grading fills.

Due to the relatively high groundwater, site grading cuts shall be kept to a minimum. Cuts extending to within 1 foot of the groundwater elevation will likely disturb the natural clay soils and proof rolling must not be completed. Stabilization must be anticipated in areas where cuts are to extend to within 1 foot of the groundwater surface.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

GSH must be notified prior to the placement of structural site grading fills, floor slabs, footings, and pavements to verify that all loose/disturbed soils and non-engineered fills have been completely removed and/or properly prepared.

5.2.2 Temporary Excavations

Temporary excavations up to 8 feet deep in fine-grained cohesive soils, above or below the water table, may be constructed with sideslopes no steeper than one-half horizontal to one vertical (0.5H:1.0V). Excavations deeper than 8 feet are not anticipated at the site.

For granular (cohesionless) soils, construction excavations above the water table, not exceeding 4 feet, shall be no steeper than one-half horizontal to one vertical (0.5H:1.0V). For excavations up to 8 feet, in granular soils and above the water table, the slopes shall be no steeper than one horizontal to one vertical (1H:1V). Excavations encountering saturated cohesionless soils will be very difficult and will require very flat sideslopes and/or shoring, bracing, and dewatering.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

The static groundwater table was encountered as shallow as 3.1 feet below the existing surface and may be shallower with seasonal fluctuations. Consideration for dewatering of utility trenches, excavations for the removal of non-engineered fill, and other excavations below this level shall be incorporated into the design and bidding process.

All excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated.

5.2.3 Structural Fill

Structural fill is defined as all fill which will ultimately be subjected to structural loadings, such as imposed by footings, floor slabs, pavements, etc. Structural fill will be required as backfill over foundations and utilities, as site grading fill, and as replacement fill below footings. All structural fill must be free of surface vegetation, root systems, rubbish, topsoil, frozen soil, and other deleterious materials.

Structural site grading fill is defined as structural fill placed over relatively large open areas to raise the overall grade. For structural site grading fill, the maximum particle size shall not exceed 4 inches; although, occasional larger particles, not exceeding 8 inches in diameter, may be incorporated if placed randomly in a manner such that “honeycombing” does not occur, and the desired degree of compaction can be achieved. The maximum particle size within structural fill placed within confined areas shall be restricted to 2 inches.

On-site soils, including existing non-engineered fills, may be re-utilized as structural site grading fill if they do not contain construction debris or deleterious material and meet the requirements of structural fill. Fine-grained soils will require very close moisture control and may be very difficult, if not impossible, to properly place and compact during wet and cold periods of the year.

Imported structural fill below foundations and floor slabs shall consist of a well graded sand and gravel mixture with less than 30 percent retained on the three-quarter-inch sieve and less than 20 percent passing the No. 200 Sieve (clays and silts).

To stabilize soft subgrade conditions (if encountered) or where structural fill is required to be placed closer than 2.0 feet above the water table at the time of construction, a mixture of coarse angular gravels and cobbles and/or 1.5- to 2.0-inch gravel (stabilizing fill) shall be utilized. It may also help to utilize a stabilization fabric, such as Mirafi 600X or equivalent, placed on the natural ground if 1.5- to 2.0-inch gravel is used as stabilizing fill.

5.2.4 Fill Placement and Compaction

All structural fill shall be placed in lifts not exceeding 8 inches in loose thickness. Structural fills shall be compacted in accordance with the percent of the maximum dry density as determined by the AASHTO² T180 (ASTM³ D1557) compaction criteria in accordance with the following table:

Location	Total Fill Thickness (feet)	Minimum Percentage of Maximum Dry Density
Beneath an area extending at least 5 feet beyond the perimeter of the structure	0 to 10	95
Site grading fills outside area defined above	0 to 5	90
Site grading fills outside area defined above	5 to 10	95
Utility trenches within structural areas	--	96
Road base	--	96

Structural fills greater than 10 feet thick are not anticipated at the site.

Subsequent to stripping and prior to the placement of structural site grading fill, the subgrade shall be prepared as discussed in Section 5.2.1, Site Preparation, of this report. In confined areas, subgrade preparation shall consist of the removal of all loose or disturbed soils.

Coarse angular gravel and cobble mixtures (stabilizing fill), if utilized, shall be end dumped, spread to a maximum loose lift thickness of 15 inches, and compacted by dropping a backhoe bucket onto the surface continuously at least twice. As an alternative, the stabilizing fill may be compacted by passing moderately heavy construction equipment or large self-propelled compaction equipment over the surface at least twice. Subsequent fill material placed over the coarse gravels and cobbles

² American Association of State Highway and Transportation Officials

³ American Society for Testing and Materials

shall be adequately compacted so that the “fines” are “worked into” the voids in the underlying coarser gravels and cobbles. Where soil fill materials are to be placed directly over more than about 18 inches of clean gravel, a separation geofabric, such as Mirafi 140N or equivalent, is recommended to be placed between the gravel and subsequent soil fills.

Non-structural fill may be placed in lifts not exceeding 12 inches in loose thickness and compacted by passing construction, spreading, or hauling equipment over the surface at least twice.

5.2.5 Utility Trenches

All utility trench backfill material below structurally loaded facilities (footings, floor slabs, flatwork, pavements, etc.) shall be placed at the same density requirements established for structural fill. If the surface of the backfill becomes disturbed during the course of construction, the backfill shall be proof rolled and/or properly compacted prior to the construction of any exterior flatwork over a backfilled trench. Proof rolling shall be performed by passing moderately loaded rubber tire-mounted construction equipment uniformly over the surface at least twice. If excessively loose or soft areas are encountered during proof rolling, they shall be removed to a maximum depth of 2 feet below design finish grade and replaced with structural fill.

Many utility companies and City-County governments are now requiring that Type A-1a or A-1b (AASHTO Designation – granular soils with limited fines) soils be used as backfill over utilities. These organizations are also requiring that in public roadways, the backfill over major utilities be compacted over the full depth of fill to at least 96 percent of the maximum dry density as determined by the AASHTO T180 (ASTM D1557) method of compaction. GSH recommends that as the major utilities continue onto the site that these compaction specifications are followed.

Fine-grained soils, such as silts and clays, are not recommended for utility trench backfill in structural areas.

The static groundwater table was encountered as shallow as 3.1 feet below the existing surface and may be shallower with seasonal fluctuations. Dewatering of utility trenches and other excavations below this level shall be anticipated.

To reduce disturbance of the natural soils during excavation, it is recommended that low-impact, track-mounted equipment with smooth edge buckets/blades be utilized.

5.3 GROUNDWATER

On April 5, 2023 (following original drilling), groundwater was measured within the PVC pipes installed as tabulated on the following page.

Boring No.	Groundwater Depth (feet)
	April 5, 2023
B-1	3.1
B-2	3.9
B-6	5.1
B-7	4.6
B-10	5.7

On August 6, 2024 (following additional drilling), groundwater was measured within the PVC pipes installed as tabulated below:

Boring No.	Groundwater Depth (feet)
	August 6, 2024
B-11	Pipe Damaged
B-12	Pipe Damaged
B-13	Pipe Damaged
B-14	5.5
B-15	Pipe Damaged

Based on the anticipated cuts necessary to reach design subgrades, we anticipate temporary dewatering will be necessary, especially in footing excavation that extend to the groundwater elevations.

Floor slabs must be placed a minimum of 4 feet from the stabilized groundwater elevation. Site grading fill may be utilized to raise the overall grade to achieve the required separation between the floor slab and the highest groundwater elevation.

The groundwater measurements presented are conditions at the time of the field exploration and may not be representative of other times or locations. Groundwater levels may vary seasonally and with precipitation, as well as other factors including irrigation. Evaluation of these factors is beyond the scope of this study. Groundwater levels may, therefore, be at shallower or deeper depths than those measured during this study, including during construction and over the life of the structure.

The extent and nature of any dewatering required during construction will be dependent on the actual groundwater conditions prevalent at the time of construction and the effectiveness of construction drainage to prevent run-off into open excavations.

5.4 SPREAD AND CONTINUOUS WALL FOUNDATIONS

5.4.1 Design Data

The results of our analysis indicate that the proposed structures may be supported upon conventional spread and continuous wall foundations established upon suitable natural soils and/or structural fill extending to suitable natural soils. Under no circumstances shall foundations be established over non-engineered fills, loose or disturbed soils, topsoil, surface vegetation, root systems, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. More heavily loaded footings will require a certain amount of granular structural replacement fill as specified in Section 5.4.3, Settlements, of this report. For design, the parameters are provided below:

Minimum Recommended Depth of Embedment for Frost Protection	- 30 inches
Minimum Recommended Depth of Embedment for Non-frost Conditions	- 15 inches
Recommended Minimum Width for Continuous Wall Footings	- 18 inches
Minimum Recommended Width for Isolated Spread Footings	- 24 inches
Recommended Net Bearing Capacity for Real Load Conditions	- 1,500 pounds per square foot
Bearing Capacity Increase for Seismic Loading	- 50 percent

The term “net bearing capacity” refers to the allowable pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total load includes all dead and live loads, including seismic and wind.

5.4.2 Installation

Under no circumstances shall the footings be installed upon non-engineered fills, loose or disturbed soils, topsoil, surface vegetation, root systems, rubbish, construction debris, or other deleterious materials. If unsuitable soils are encountered, they must be removed and replaced with compacted granular fill. If granular soils become loose or disturbed, they must be recompacted prior to pouring the concrete.

The width of structural replacement fill below footings shall be equal to the width of the footing plus one foot for each foot of fill thickness.

5.4.3 Settlements

Granular structural replacement fill will be required under more heavily loaded footings. For the required amount, refer to the table below:

Foundations	Loading	Minimum Thickness of Replacement Structural Granular Fill (feet)
Wall	Up to 6 kips per lineal foot	1.0
Spread	Up to 115 kips	1.0
	115 kips to 165 kips	2.0
	165 kips to 220 kips	3.0

Based on column loadings, soil bearing capacities, and the foundation recommendations as discussed above, we expect primary total settlement beneath individual foundations to be less than one inch.

The amount of differential settlement is difficult to predict because the subsurface and foundation loading conditions can vary considerably across the site. However, we anticipate differential settlement between adjacent foundations could vary from 0.5 to 0.75 inch. The final deflected shape of the structure will be dependent on actual foundation locations and loading.

5.5 LATERAL RESISTANCE

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of friction of 0.35 may be utilized for the footing interface with in situ natural clay soils and 0.40 for footing interface with granular structural fill. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of

300 pounds per cubic foot. Below the water table, this granular soil shall be considered equivalent to a fluid with a density of 150 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by 1.5.

5.6 FLOOR SLABS

Floor slabs may be established upon suitable natural subgrade soils or structural fill extending to suitable natural soils. Under no circumstances shall floor slabs be established directly over non-engineered fills, loose or disturbed soils, sod, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water.

Additionally, GSH recommends that floor slabs be constructed a minimum of 4.0 feet from the stabilized groundwater elevation. Site grading fill may be utilized to raise the overall grade to achieve the required separation between the floor slab and the highest groundwater elevation.

To facilitate curing of the concrete and to provide a capillary moisture break, it is recommended that floor slabs be directly underlain by at least 4 inches of “free-draining” fill, such as “pea” gravel or three-quarters to one inch minus clean gap-graded gravel.

Settlement of lightly loaded floor slabs designed according to previous recommendations (average uniform pressure of 200 pounds per square foot or less) is anticipated to be less than one-quarter of an inch.

5.7 PAVEMENTS

The natural clay soils will exhibit poor pavement support characteristics when saturated. All pavement areas must be prepared as previously discussed (see Section 5.2.1, Site Preparation). Under no circumstances shall pavements be established over unprepared non-engineered fills, loose or disturbed soils, topsoil, surface vegetation, root systems, rubbish, construction debris, other deleterious materials, frozen soils, or within ponded water. With the subgrade soils and the estimated projected traffic as discussed in Section 2, Proposed Construction, the pavement sections on the following pages are recommended.

Parking Areas

(Light Volume of Automobiles and Light Trucks,
 Occasional Medium-Weight Trucks,
 and No Heavyweight Trucks)
 [3 equivalent 18-kip axle loads per day]

Flexible Pavements: (Asphalt Concrete)

3.0 inches	Asphalt concrete
8.0 inches	Aggregate base
Over	Properly prepared natural subgrade soils, and/or structural site grading fill extending to properly prepared natural subgrade soils

Rigid Pavements: (Non-reinforced Concrete)

5.0 inches	Portland cement concrete (non-reinforced)
5.0 inches	Aggregate base
Over	Properly prepared natural subgrade soils and/or structural site grading fill extending to properly prepared natural subgrade soils

Light-Duty Drive Lanes

(Moderate Volume of Automobiles and Light Trucks,
 Light Volume of Medium-Weight Trucks,
 and Occasional Heavyweight Trucks)
 [6 equivalent 18-kip axle loads per day]

Flexible Pavements:
 (Asphalt Concrete)

3.0 inches	Asphalt concrete
9.0 inches	Aggregate base
Over	Properly prepared natural subgrade soils, and/or structural site grading fill extending to properly prepared natural subgrade soils

Rigid Pavements:
 (Non-reinforced Concrete)

6.0 inches	Portland cement concrete (non-reinforced)
5.0 inches	Aggregate base
Over	Properly prepared natural subgrade soils and/or structural site grading fill extending to properly prepared natural subgrade soils

Heavy-Duty Drive Lanes and Loading/Unloading Areas

(Moderate Volume of Automobiles, Light Trucks,
 and Medium-Weight Trucks,
 with a Light Volume of Heavyweight Trucks)
 [40 equivalent 18-kip axle loads per day]

Flexible Pavements: (Asphalt Concrete)

4.0 inches	Asphalt concrete
8.0 inches	Aggregate base
8.0 inches*	Aggregate subbase
Over	Properly prepared natural subgrade soils, and/or structural site grading fill extending to properly prepared natural subgrade soils

* Subbase may consist of granular site grading fills with a minimum California Bearing Ratio (CBR) of 30 percent.

Rigid Pavements: (Non-reinforced Concrete)

7.0 inches	Portland cement concrete (non-reinforced)
6.0 inches	Aggregate base
Over	Properly prepared natural subgrade soils and/or structural site grading fill extending to properly prepared natural subgrade soils

For dumpster pads, we recommend a pavement section consisting of 8.0 inches of Portland cement concrete, 12.0 inches of aggregate base, over properly prepared natural subgrade or site grading structural fills. Dumpster pads shall not be constructed overlying non-engineered fills under any circumstances.

The above rigid pavement sections are for non-reinforced Portland cement concrete. Concrete shall be designed in accordance with the American Concrete Institute (ACI) and joint details shall conform to the Portland Cement Association (PCA) guidelines. The concrete shall have a minimum 28-day unconfined compressive strength of 4,000 pounds per square inch and contain 6 percent $\pm$ 1 percent air-entrainment.

The crushed stone shall conform to applicable sections of the current Utah Department of Transportation (UDOT) Standard Specifications. All asphalt material and paving operations shall meet applicable specifications of the Asphalt Institute and UDOT. A GSH technician shall observe placement and perform density testing of the base course material and asphalt.

Please note that the recommended pavement section is based on estimated post-construction traffic loading. If the pavement is to be constructed and utilized by construction traffic, the above pavement section may prove insufficient for heavy truck traffic, such as concrete trucks or tractor-trailers used for construction delivery. Unexpected distress, reduced pavement life, and/or premature failure of the pavement section could result if subjected to heavy construction traffic and the owner shall be made aware of this risk. If the estimated traffic loading stated herein is not correct, GSH must review actual pavement loading conditions to determine if revisions to these recommendations are warranted.

5.8 CEMENT TYPES

The laboratory tests indicate that the natural soils tested contain a negligible amount of water-soluble sulfates. Based on our test results, concrete in contact with the on-site soil will have a low potential for sulfate reaction (ACI 318, Table 4.3.1). Therefore, all concrete which will be in contact with the site soils may be prepared using Type I or IA cement.

5.9 GEOSEISMIC SETTING

5.9.1 General

Utah municipalities have adopted the International Building Code (IBC) 2021. The IBC 2021 code refers to ASCE 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7-16) determines the seismic hazard for a site based upon mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class. The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points).

5.9.2 Faulting

Based on our review of available literature, no active faults pass through or immediately adjacent to the site. The nearest active mapped fault consists of the Provo Section of the Wasatch Fault, located about 2.7 miles to the east of the site.

5.9.3 Site Class

For dynamic structural analysis, the Site Class D – Default Soil Profile as defined in Chapter 20 of ASCE 7-16 (per Section 1613.3.2, Site Class Definitions, of IBC 2018) can be utilized. If a measured site class is desired based on the project structural engineer's evaluation and

recommendations, additional testing and analysis can be completed by GSH to determine the measured site class. Please contact GSH for additional information.

5.9.4 Ground Motions

The IBC 2021 code is based on USGS mapping, which provides values of short and long period accelerations for average bedrock values for the Western United States and must be corrected for local soil conditions. The following table summarizes the peak ground and short and long period accelerations for the MCE event and incorporates the appropriate soil amplification factor for a Site Class D – Default* Soil Profile. Based on the site latitude and longitude (40.1572 degrees north and 111.6727 degrees west, respectively) and Risk Category I, the values for this site are tabulated below:

Spectral Acceleration Value, T	Bedrock Boundary [mapped values] (% g)	Site Coefficient	Site Class D - Default* [adjusted for site class effects] (% g)	Design Values** (% g)
0.2 Seconds (Short Period Acceleration)	$S_S = 143.7$	$F_a = 1.200$	$S_{MS} = 172.4$	$S_{DS} = 114.9$
1.0 Second (Long Period Acceleration)	$S_1 = 52.1$	$F_v = 1.779$	$S_{M1} = 92.7$	$S_{D1} = 61.8$

* If a measured site class in accordance with IBC 2021/ASCE 7-16 is beneficial based on the project structural engineer's review, please contact GSH for additional options for obtaining this measured site class.

**IBC 2021/ASCE 7-16 may require a site-specific study based on the project structural engineer's evaluation and recommendations. If needed, GSH can provide additional information and analysis including a complete site-specific study in accordance with chapter 21 of ASCE 7-16.

5.9.5 Liquefaction

The site is located in an area that has been identified by the Utah Geological Survey (UGS) as being a "high" liquefaction potential zone. Liquefaction is defined as the condition when saturated, loose, granular soils lose their support capabilities because of excessive pore water pressure, which develops during a seismic event. Clayey soils, even if saturated, will generally not liquefy during a major seismic event.

Due to the clayey nature of the soils, liquefaction is not anticipated to occur within the soils encountered at this site.

5.10 SITE VISITS

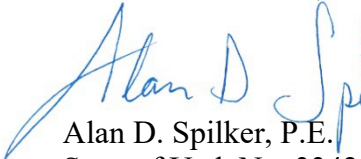
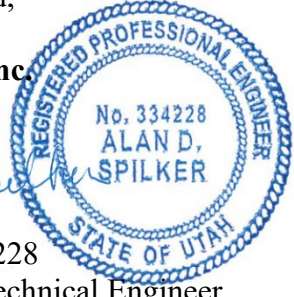
GSH must verify that all topsoil/disturbed soils and any other unsuitable soils have been removed, that non-engineered fills have been removed and/or properly prepared, and that suitable soils have been encountered prior to placing site grading fills, footings, slabs, and pavements. Additionally, GSH must observe fill placement and verify in-place moisture content and density of fill materials placed at the site.

6. CLOSURE

If you have any questions or would like to discuss these items further, please feel free to contact us at (801) 685-9190.

Respectfully submitted,

GSH Geotechnical, Inc.

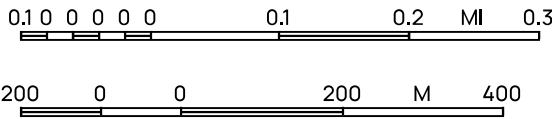
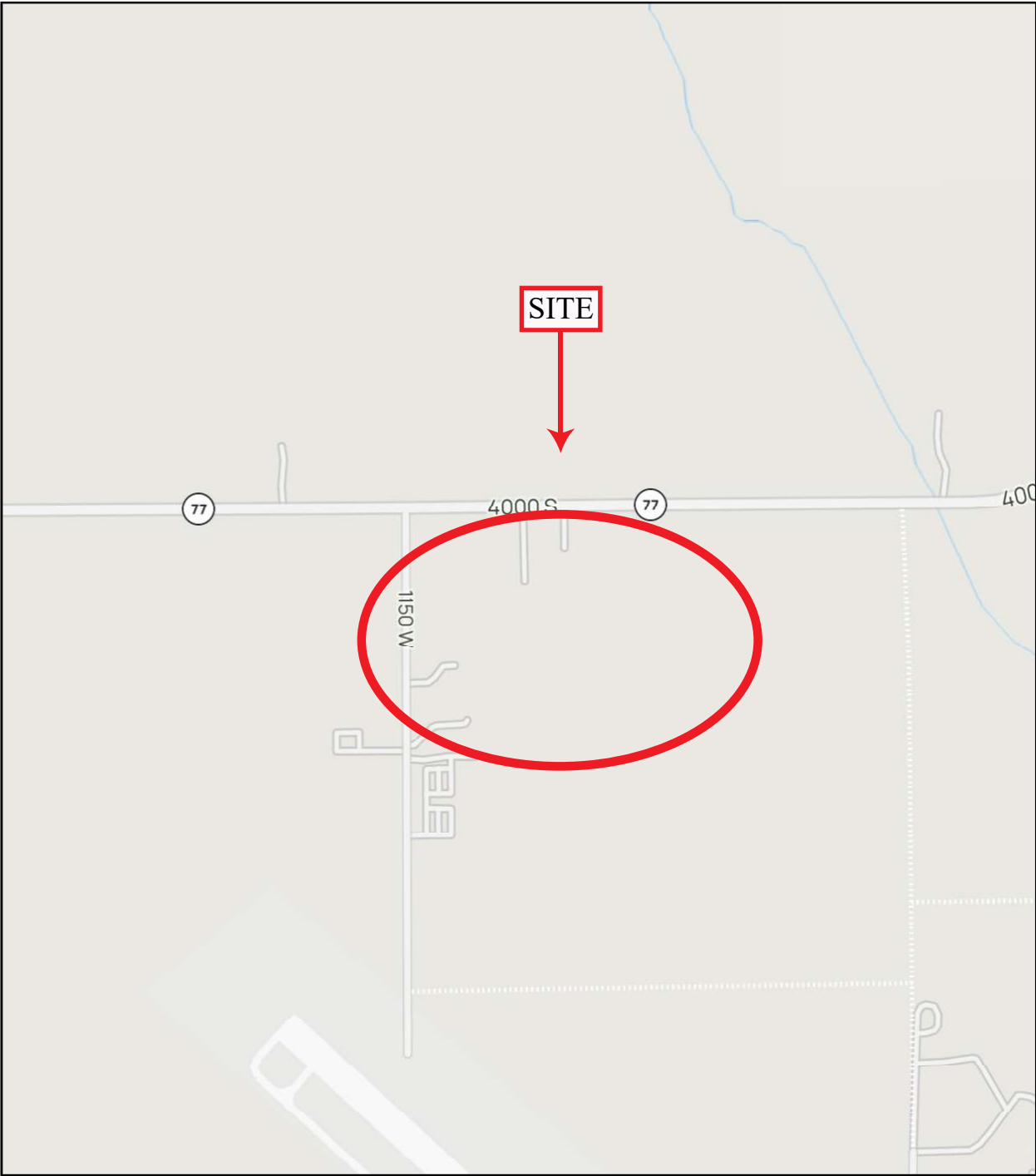
A handwritten signature in blue ink that reads "Alan D. Spilker".
A circular blue ink seal for a Registered Professional Engineer in the State of Utah. The seal contains the text "REGISTERED PROFESSIONAL ENGINEER", "No. 334228", "ALAN D. SPILKER", and "STATE OF UTAH".

Alan D. Spilker, P.E.
State of Utah No. 334228
President/Senior Geotechnical Engineer

ADS:jmt

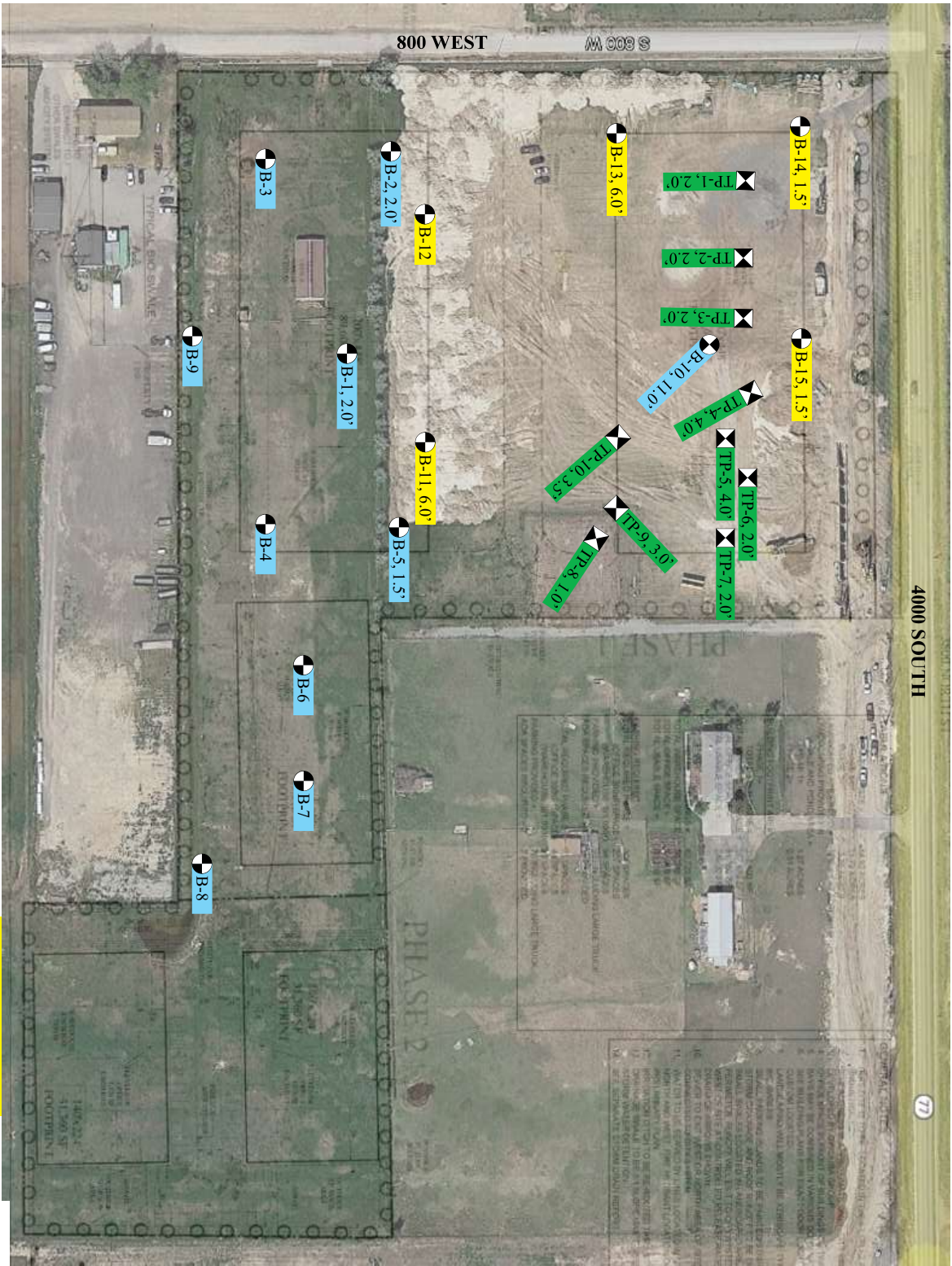
Encl. Figure 1, Vicinity Map
Figure 2, Site Plan
Figures 3A through 3O, Boring Logs
Figures 4A through 4H, Test Pit Logs
Figure 5, Key to Boring Log (USCS)
Figure 6, Key to Test Pit Log (USCS)

Addressee (email)



REFERENCE:
ALL TRAILS - NATIONAL GEOGRAPHIC TERRAIN
DATED 2024

FIGURE 1
VICINITY MAP
 GSH



REFERENCE:
ADAPTED FROM AERIAL PHOTOGRAPH
DOWNLOADED FROM GOOGLE EARTH
IMAGERY DATED 5/2022



KEY:
●✕ Boring No./Test Pit No., Fill Thickness (feet)

Current Report Borings
Current Report Test Pits
Borings from April 26, 2023



FIGURE 2
SITE PLAN



GSH

BORING LOG

Page: 1 of 2

BORING: B-1

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/23/23

DATE FINISHED: 3/23/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 3.1' (4/5/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								moist soft
	CL FILL	SILTY CLAY, FILL with major roots (topsoil) to 6"; brown									
	CL	SILTY CLAY with some fine sand and trace fine gravel; gray/light brown									moist very soft saturated
			5	0					33	13	
				0							
		grades light brown	10	0							
		grades fine sandy clay with silt; light reddish-brown	15	1							
		grades with some fine gravel; light brown	20	1							
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3A



GSH

BORING LOG

Page: 2 of 2

BORING: B-1

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/23/23

DATE FINISHED: 3/23/23

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
			25								
		grades with layers of fine sand up to 2" thick	0								
		grades with layers of fine sand up to 1" thick; light reddish-brown/tan	30	0							
		grades fine sandy clay									
		grades with layers of fine to coarse sand up to 1/2" thick									
		grades fine sandy clay; light brown/red	35	0							
		grades red	40	0					37	19	
		grades light brown	45	0							
		grades gray and black									
		End of Exploration at 46.5'. Installed 1.25" diameter slotted PVC pipe to 46.5'.									
			50								

See Subsurface Conditions section in the report for additional information.

FIGURE 3A
(continued)



GSH

BORING LOG

Page: 1 of 1

BORING: B-2

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/24/23

DATE FINISHED: 3/24/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 3.9' (4/5/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								moist stiff moist very soft saturated
	CL	SILTY CLAY, FILL									
	FILL	with major roots (topsoil) to 6"; brown									
	CL	SILTY CLAY									
		grades reddish-brown		0							
		grades fine sandy clay; gray/brown									
		grades silty clay; reddish-brown	5	0		25.7					
		grades with layers of fine to coarse sand up to 1/2" thick; dark gray	10	0		26.6	94				
		End of Exploration at 11.0'. No groundwater encountered at time of drilling. Installed 1.25" diameter slotted PVC pipe to 11.0'.									
			15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3B



GSH

BORING LOG

Page: 1 of 1

BORING: B-3

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/24/23

DATE FINISHED: 3/24/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 6.0' (3/24/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
	CL	Ground Surface	0								moist very soft
		SILTY CLAY with major roots (topsoil) to 6"; brown									
		grades gray/brown	5	0							
		grades brown									saturated
		grades reddish-brown		1		32.1	89				
			10	0		22.1	96				
		grades fine sandy clay; light brown	15	0		26.7	84				
		End of Exploration at 16.0'.									
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3C



GSH

BORING LOG

Page: 1 of 1

BORING: B-4

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/27/23

DATE FINISHED: 3/27/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 4.0' (3/27/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
	CL	Ground Surface	0								moist
		SILTY CLAY with major roots (topsoil) to 6"; brown		3		32.3	87				very moist
			5								saturated
		grades light brown		0							very soft
			10	0		37.8	86				
		End of Exploration at 11.0'. No groundwater encountered at time of drilling.									
			15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3D



GSH

BORING LOG

Page: 1 of 1

BORING: B-5

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/27/23

DATE FINISHED: 3/27/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 5.0' (3/27/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								moist stiff
	CL FILL	SILTY CLAY, FILL with major roots (topsoil) to 8"; light brown									moist stiff
	CL	SILTY CLAY brown		12							
		grades reddish-brown	5	4							saturated soft
		grades fine sandy clay with some silty clay and organics	10	2		34.2	97				very soft
		grades light brown	15	3							soft
		grades silty clay; red									
		End of Exploration at 16.0'.									
		No groundwater encountered at time of drilling.									
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3E



BORING LOG

Page: 1 of 1

BORING: B-6

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/27/23

DATE FINISHED: 3/27/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 5.1' (4/5/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS	
	CL	Ground Surface		0							moist medium stiff	
		SILTY CLAY with major roots (topsoil) to 6"; brown grades reddish-brown										
			6									
		grades red	5									saturated very soft
			0		30.4	95						
		grades light brown	10									
			0									
		grades red										
			15	3								soft
		End of Exploration at 16.0'. No groundwater encountered at time of drilling. Installed 1.25" diameter slotted PVC pipe to 16.0'.										
			20									
			25									

See Subsurface Conditions section in the report for additional information.

FIGURE 3F



GSH

BORING LOG

Page: 1 of 1

BORING: B-7

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/27/23

DATE FINISHED: 3/27/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 4.6' (4/5/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
	CL	Ground Surface	0								moist soft
		SILTY CLAY with major roots (topsoil) to 8"; brown									
		grades dark brown grades reddish brown		3							
			5								saturated
		grades fine sandy clay; light brown		2		27.8	91				very soft
		grades silty clay; red									
		grades light reddish-brown	10	0		34.2	85				
		grades with layers of fine sand up to 4" thick									
			15	2							
		grades fine sandy clay; red/light brown									
		grades silty clay; red	20	4							5' heave soft
		End of Exploration at 21.0'. No groundwater encountered at time of drilling. Installed 1.25" diameter slotted PVC pipe to 21.0'.									
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3G



GSH

BORING LOG

Page: 1 of 1

BORING: B-8

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/27/23

DATE FINISHED: 3/27/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: Not Encountered (3/27/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								moist soft
	CL	SILTY CLAY with major roots (topsoil) to 4"; light brown									
		End of Exploration at 5.0'. No groundwater encountered at time of drilling.	5								
			10								
			15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3H



GSH

BORING LOG

Page: 1 of 1

BORING: B-9

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/27/23

DATE FINISHED: 3/27/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: Not Encountered (3/27/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								
	CL	SILTY CLAY with major roots (topsoil) to 6"; light brown									moist soft
		End of Exploration at 5.0'. No groundwater encountered at time of drilling.	5								
			10								
			15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 31



GSH

BORING LOG

Page: 1 of 2

BORING: B-10

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/27/23

DATE FINISHED: 3/27/23

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: BD

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 5.7' (4/5/23)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								moist
	CL	SILTY CLAY, FILL									soft
	FILL	with fine and coarse gravel; tan/light brown									moist
	CL	SILTY CLAY									soft
		with some fine sand; brown									
		grades with organics; light brown	5	3							saturated
		grades light brown and red		0							very soft
			10	0							
		grades red									
		grades fine sandy clay; light brown	15	2		29.9		57.2			
		grades with layers of fine sand up to 3" thick									
			20	4							
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3J



GSH

BORING LOG

Page: 2 of 2

BORING: B-10

CLIENT: GWC Capital

PROJECT NUMBER: 3621-004-23

PROJECT: Proposed Spanish Fork South Office/Warehouse/Data Center

DATE STARTED: 3/27/23

DATE FINISHED: 3/27/23

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
			25								
		grades with layers of fine to medium sand up to 6" thick		10		28.6		66.9			stiff
			30								
		grades with fine sand; red		6							medium stiff
		grades with layers of fine to medium sand up to 4" thick; light brown	35								
				4							
		grades red									
			40								
		grades light brown		9							stiff
		grades red									
		grades tan/gray	45								
		grades with layers of fine to medium sand up to 1" thick; gray		12							
		grades fine sandy clay; dark gray									
		End of Exploration at 46.5'.									
		Installed 1.25" diameter slotted PVC pipe to 46.5'.									
			50								

See Subsurface Conditions section in the report for additional information.

FIGURE 3J
(continued)



GSH

BORING LOG

Page: 1 of 1

BORING: B-11

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 8.0' (5/8/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								moist very stiff
	CL	SILTY CLAY, FILL with trace fine sand and fine gravel; brown		51							
			5	19		27.2	94				stiff very moist stiff
	CL	SILTY CLAY with trace fine sand; brown									saturated
			10	10							medium stiff
			15	2		31.8		73.8			soft
		End of Exploration at 16.5'. Installed 1.25" diameter slotted PVC pipe to 16.5'.									
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3K



GSH

BORING LOG

Page: 1 of 1

BORING: B-12

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 8.0' (5/8/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
	CL	Ground Surface	0								very moist very stiff
		SILTY CLAY with trace fine sand; brown		39							
			5	17							stiff
											saturated
		sand grades out	10	5		24.6	94				medium stiff
		End of Exploration at 11.5'. Installed 1.25" diameter slotted PVC pipe to 11.5'.									
			15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3L



GSH

BORING LOG

Page: 1 of 1

BORING: B-13

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 8.0' (5/8/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								moist very stiff
	CL FILL	SILTY CLAY, FILL with fine and coarse gravel and fine to coarse sand; brown		43							
			5	17		20.5	100				stiff very moist stiff
	CL	SILTY CLAY with trace fine sand; brown									saturated
			10	8							medium stiff
		End of Exploration at 11.5'. Installed 1.25" diameter slotted PVC pipe to 11.5'.									
			15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3M



GSH

BORING LOG

Page: 1 of 1

BORING: B-14

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 5.5' (8/6/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								dry medium stiff
	CL FILL	SILTY CLAY, FILL with fine and coarse gravel; brown									moist hard
	CL	SILTY CLAY with trace oxidation; brown		70							
			5	22							saturated very stiff
		grades with trace sand and oxidation									
			10	7							medium stiff
		sand and oxidation grade out									
			15	7		35.1		66.9			
		grades fine to coarse sandy clay with silt; brown/tan									
		End of Exploration at 16.5'. Installed 1.25" diameter slotted PVC pipe to 16.5'.									
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 3N



GSH

BORING LOG

Page: 1 of 1

BORING: B-15

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

DRILLING METHOD/EQUIPMENT: 4-1/4" ID Hollow-Stem Auger

HAMMER: Automatic

WEIGHT: 140 lbs

DROP: 30"

GROUNDWATER DEPTH: 5.0' (5/8/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0								dry stiff
	CL FILL	SILTY CLAY, FILL with trace fine and coarse gravel; light brown									moist hard
	CL	SILTY CLAY brown		63		18.6	107				
		grades with trace fine sand	5	26							saturated very stiff
		grades with trace fine to coarse sand; gray/brown	10	7							medium stiff
		End of Exploration at 11.5'. Installed 1.25" diameter slotted PVC pipe to 11.5'.									
			15								
			20								
			25								

See Subsurface Conditions section in the report for additional information.

FIGURE 30



GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-1

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 7/17/24

DATE FINISHED: 7/17/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (7/17/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	CL FILL	FINE TO COARSE SANDY CLAY, FILL with fine and coarse gravel; major roots (topsoil) to 6"; tan/brown								dry medium stiff
	CL	SILTY CLAY with trace fine gravel, trace fine sand, and trace organics; brown								moist medium stiff
		End of Exploration at 5.0'. No significant sidewall caving. No groundwater encountered at time of excavation.	5							
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4A



GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-2

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 7/17/24

DATE FINISHED: 7/17/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (7/17/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	CL FILL	FINE SANDY CLAY, FILL with fine and coarse gravel and trace coarse silty sand; major roots (topsoil) to 6"; tan/brown								dry soft
	CL	SILTY CLAY with trace fine gravel, trace fine sand, and trace organics; brown								moist stiff
			5							
		End of Exploration at 5.5'. No significant sidewall caving. No groundwater encountered at time of excavation.								
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4B



GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-3

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 6/18/24

DATE FINISHED: 6/18/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (6/18/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	CL FILL	FINE SANDY CLAY, FILL with fine and coarse gravel and trace coarse sand; major roots (topsoil) to 8"; tan/red								dry soft
	CL	SILTY CLAY with trace fine sand, trace fine gravel, and organics; brown								moist medium stiff
		End of Exploration at 4.0'. No significant sidewall caving. No groundwater encountered at time of excavation.	5							
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4C



GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-4

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (5/8/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	CL FILL	FINE SANDY CLAY, FILL with fine and coarse gravel; major roots (topsoil) to 6"; tan/brown								dry soft
	CL	SILTY CLAY with trace fine gravel and trace fine sand, brown	5							moist medium stiff
		End of Exploration at 5.5'. No significant sidewall caving. No groundwater encountered at time of excavation.								
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4D



GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-5

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (5/8/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	CL FILL	FINE TO MEDIUM SANDY CLAY, FILL with fine and coarse gravel and trace coarse silty sand; major roots (topsoil) to 6"; tan/brown								dry medium stiff
	CL	SILTY CLAY with trace fine gravel and trace organics; dark brown	5							moist medium stiff
		End of Exploration at 5.5'. No significant sidewall caving. No groundwater encountered at time of excavation.								
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4E



GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-6

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (5/8/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	CL FILL	FINE SANDY CLAY, FILL with fine and coarse gravel and trace coarse sand; major roots (topsoil) to 6"; brown/tan								dry soft
	CL	SILTY CLAY with trace fine sand, trace fine gravel, and organics; dark brown								moist medium stiff
		End of Exploration at 4.0'. No significant sidewall caving. No groundwater encountered at time of excavation.	5							
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4F



GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-7

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (5/8/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	CL FILL	FINE SILTY SANDY CLAY, FILL with fine and coarse gravel; major roots (topsoil) to 6"; brown/tan								dry medium stiff
	CL	SILTY CLAY with some fine sand; brown								slightly moist medium stiff
		End of Exploration at 3.0'. No significant sidewall caving. No groundwater encountered at time of excavation.								
			5							
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4G



TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-8

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 5/8/24

DATE FINISHED: 5/8/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (5/8/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							dry medium stiff moist medium stiff
	CL	FINE TO MEDIUM SANDY CLAY, FILL								
	FILL	with fine and coarse gravel; major roots (topsoil) to 4"; brown/tan								
	CL	SILTY CLAY								
		with trace fine gravel; organics; brown								
		End of Exploration at 4.5'. No significant sidewall caving. No groundwater encountered at time of excavation.	5							
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4H



GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-9

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 7/17/24

DATE FINISHED: 7/17/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (7/17/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	CL FILL	FINE TO MEDIUM SANDY CLAY, FILL with fine and coarse gravel; major roots (topsoil) to 6"; tan/brown								dry medium stiff
	CL	SILTY CLAY with fine to coarse sand, trace fine gravel, and organics; brown								moist medium stiff
		End of Exploration at 5.0'. No significant sidewall caving. No groundwater encountered at time of excavation.	5							
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4G



GSH

TEST PIT LOG

Page: 1 of 1

TEST PIT: TP-10

CLIENT: Turner Group

PROJECT NUMBER: 3898-001-24

PROJECT: Proposed Spanish Fork Project

DATE STARTED: 7/17/24

DATE FINISHED: 7/17/24

LOCATION: Approximately 800 West 4000 South, Spanish Fork, Utah

GSH FIELD REP.: JC

EXCAVATING METHOD/EQUIPMENT: Mini Excavator

GROUNDWATER DEPTH: Not Encountered (7/17/24)

ELEVATION: ---

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
		Ground Surface	0							
	CL FILL	FINE TO MEDIUM SANDY CLAY, FILL with fine and coarse gravel and trace coarse sand; major roots (topsoil) to 6"; tan/brown								dry medium stiff
	CL	SILTY CLAY with trace fine to coarse sand, trace fine gravel, and organics; dark brown	5							moist medium stiff
		End of Exploration at 5.5'. No significant sidewall caving. No groundwater encountered at time of excavation.								
			10							
			15							
			20							
			25							

See Subsurface Conditions section in the report for additional information.

FIGURE 4H

CLIENT: Turner Group
PROJECT: Proposed Spanish Fork Project
PROJECT NUMBER: 3898-001-24

KEY TO BORING LOG

WATER LEVEL		U S C S	DESCRIPTION	DEPTH (FT.)	BLOW COUNT	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
①	②		③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫
COLUMN DESCRIPTIONS												
①	Water Level: Depth to measured groundwater table. See symbol below.					⑩	Liquid Limit (%): Water content at which a soil changes from plastic to liquid behavior.					
②	USCS: (Unified Soil Classification System) Description of soils encountered; typical symbols are explained below.					⑪	Plasticity Index (%): Range of water content at which a soil exhibits plastic properties.					
③	Description: Description of material encountered; may include color, moisture, grain size, density/consistency,					⑫	Remarks: Comments and observations regarding drilling or sampling made by driller or field personnel. May include other field and laboratory test results using the following abbreviations:					
④	Depth (ft.): Depth in feet below the ground surface.					CEMENTATION:			MODIFIERS:		MOISTURE CONTENT (FIELD TEST):	
⑤	Blow Count: Number of blows to advance sampler 12" beyond first 6", using a 140-lb hammer with 30" drop.					Weakly: Crumbles or breaks with handling or slight finger pressure.			Trace <5%		Dry: Absence of moisture, dusty, dry to the touch.	
⑥	Sample Symbol: Type of soil sample collected at depth interval shown; sampler symbols are explained below.					Moderately: Crumbles or breaks with considerable finger pressure.			Some 5-12%		Moist: Damp but no visible water.	
⑦	Moisture (%): Water content of soil sample measured in laboratory; expressed as percentage of dryweight of					Strongly: Will not crumble or break with finger pressure.			With > 12%		Saturated: Visible water, usually soil below water table.	
⑧	Dry Density (pcf): The density of a soil measured in laboratory; expressed in pounds per cubic foot.					Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on the logs apply only at the specific boring locations and at the time the borings were advanced; they are not warranted to be representative of subsurface conditions at other locations or times.						
⑨	% Passing 200: Fines content of soils sample passing a No. 200 sieve; expressed as a percentage.											
MAJOR DIVISIONS				USCS SYMBOLS	TYPICAL DESCRIPTIONS							
COARSE-GRAINED SOILS More than 50% of material is larger than No. 200 sieve size.	GRAVELS More than 50% of coarse fraction retained on No. 4 sieve.	CLEAN GRAVELS (little or no fines)	GW	Well-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines								
			GP	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines								
		GRAVELS WITH FINES (appreciable amount of fines)	GM	Silty Gravels, Gravel-Sand-Silt Mixtures								
			GC	Clayey Gravels, Gravel-Sand-Clay Mixtures								
	SANDS More than 50% of coarse fraction passing through No. 4 sieve.	CLEAN SANDS (little or no fines)	SW	Well-Graded Sands, Gravelly Sands, Little or No Fines								
			SP	Poorly-Graded Sands, Gravelly Sands, Little or No Fines								
SANDS WITH FINES (appreciable amount of fines)		SM	Silty Sands, Sand-Silt Mixtures									
		SC	Clayey Sands, Sand-Clay Mixtures									
FINE-GRAINED SOILS More than 50% of material is smaller than No. 200 sieve size.	SILTS AND CLAYS Liquid Limit less than 50%		ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity								
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays								
			OL	Organic Silts and Organic Silty Clays of Low Plasticity								
	SILTS AND CLAYS Liquid Limit greater than 50%		MH	Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils								
			CH	Inorganic Clays of High Plasticity, Fat Clays								
			OH	Organic Silts and Organic Clays of Medium to High Plasticity								
		HIGHLY ORGANIC SOILS		PT	Peat, Humus, Swamp Soils with High Organic Contents							
STRATIFICATION:												
DESCRIPTION		THICKNESS										
Seam		up to 1/8"										
Layer		1/8" to 12"										
Occasional: One or less per 6" of thickness												
Numerous: More than one per 6" of thickness												
TYPICAL SAMPLER GRAPHIC SYMBOLS												
		Bulk/Bag Sample										
		Standard Penetration Split Spoon Sampler										
		Rock Core										
		No Recovery										
		California Sampler										
		Thin Wall										
WATER SYMBOL												
		Water Level										

Note: Dual Symbols are used to indicate borderline soil classifications.

Note: Dual Symbols are used to indicate borderline soil classifications.

FIGURE 5



CLIENT: Turner Group
PROJECT: Proposed Spanish Fork Project
PROJECT NUMBER: 3898-001-24

KEY TO TEST PIT LOG

WATER LEVEL	U S C S	DESCRIPTION	DEPTH (FT.)	SAMPLE SYMBOL	MOISTURE (%)	DRY DENSITY (PCF)	% PASSING 200	LIQUID LIMIT (%)	PLASTICITY INDEX	REMARKS
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪

COLUMN DESCRIPTIONS

- ① **Water Level:** Depth to measured groundwater table. See symbol below.
- ② **USCS:** (Unified Soil Classification System) Description of soils encountered; typical symbols are explained below.
- ③ **Description:** Description of material encountered; may include color, moisture, grain size, density/consistency.
- ④ **Depth (ft.):** Depth in feet below the ground surface.
- ⑤ **Sample Symbol:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.
- ⑥ **Moisture (%):** Water content of soil sample measured in laboratory; expressed as percentage of dryweight of
- ⑦ **Dry Density (pcf):** The density of a soil measured in laboratory; expressed in pounds per cubic foot.
- ⑧ **% Passing 200:** Fines content of soils sample passing a No. 200 sieve; expressed as a percentage.
- ⑨ **Liquid Limit (%):** Water content at which a soil changes from plastic to liquid behavior.
- ⑩ **Plasticity Index (%):** Range of water content at which a soil exhibits plastic properties.
- ⑪ **Remarks:** Comments and observations regarding drilling or sampling made by driller or field personnel. May include other field and laboratory test results using the following abbreviations:

CEMENTATION:

Weakly: Crumbles or breaks with handling or slight finger pressure.

Moderately: Crumbles or breaks with considerable finger pressure.

Strongly: Will not crumble or break with finger pressure.

MODIFIERS:

Trace
<5%

Some
5-12%

With
> 12%

MOISTURE CONTENT (FIELD TEST):

Dry: Absence of moisture, dusty, dry to the touch.

Moist: Damp but no visible water.

Saturated: Visible water, usually soil below water table.

Descriptions and stratum lines are interpretive; field descriptions may have been modified to reflect lab test results. Descriptions on the logs apply only at the specific boring locations and at the time the borings were advanced; they are not warranted to be representative of subsurface conditions at other locations or times.

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS SYMBOLS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS More than 50% of material is larger than No. 200 sieve size.	GRAVELS More than 50% of coarse fraction retained on No. 4 sieve.	CLEAN GRAVELS (little or no fines)	GW	Well-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
		GRAVELS WITH FINES (appreciable amount of fines)	GP	Poorly-Graded Gravels, Gravel-Sand Mixtures, Little or No Fines
			GM	Silty Gravels, Gravel-Sand-Silt Mixtures
			GC	Clayey Gravels, Gravel-Sand-Clay Mixtures
	SANDS More than 50% of coarse fraction passing through No. 4 sieve.	CLEAN SANDS (little or no fines)	SW	Well-Graded Sands, Gravelly Sands, Little or No Fines
		SANDS WITH FINES (appreciable amount of fines)	SP	Poorly-Graded Sands, Gravelly Sands, Little or No Fines
			SM	Silty Sands, Sand-Silt Mixtures
			SC	Clayey Sands, Sand-Clay Mixtures
FINE-GRAINED SOILS More than 50% of material is smaller than No. 200 sieve size.	SILTS AND CLAYS Liquid Limit less than 50%		ML	Inorganic Silts and Very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with Slight Plasticity
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL	Organic Silts and Organic Silty Clays of Low Plasticity
	SILTS AND CLAYS Liquid Limit greater than 50%		MH	Inorganic Silts, Micaceous or Diatomaceous Fine Sand or Silty Soils
			CH	Inorganic Clays of High Plasticity, Fat Clays
			OH	Organic Silts and Organic Clays of Medium to High Plasticity
HIGHLY ORGANIC SOILS			PT	Peat, Humus, Swamp Soils with High Organic Contents

STRATIFICATION:

DESCRIPTION	THICKNESS
Seam	up to 1/8"
Layer	1/8" to 12"
Occasional: One or less per 6" of thickness	
Numerous: More than one per 6" of thickness	

TYPICAL SAMPLER GRAPHIC SYMBOLS

-  Bulk/Bag Sample
-  Standard Penetration Split Spoon Sampler
-  Rock Core
-  No Recovery
-  3.25" OD, 2.42" ID D&M Sampler
-  3.0" OD, 2.42" ID D&M Sampler
-  California Sampler
-  Thin Wall

WATER SYMBOL

-  Water Level

Note: Dual Symbols are used to indicate borderline soil classifications.

FIGURE 6



April 24, 2026
Job No. 3898-001-24

Mr. Jay S. Turner
Turner Group
18 West Lawrence Street, Suite 100
Pontiac, Michigan 48352

Mr. Turner:

Re: Letter – Addendum No. 1
Lateral Pressures and Subgrade Modulus
Proposed Spanish Fork Project
Approximately 800 West 4000 South
Spanish Fork, Utah

Introduction

GSH Geotechnical, Inc. (GSH) was requested to provide lateral pressures and a subgrade modulus of the natural clay soils encountered at the site. GSH completed the original geotechnical study¹ and a subsurface soil assessment² for the above-referenced site dated August 20, 2024 and May 31, 2024, respectively. This letter is intended to serve as an addendum to the referenced geotechnical study.

Lateral Pressures

Parameters, as presented within this section, are for backfills which will consist of drained soil placed and compacted in accordance with the recommendations presented herein.

The lateral pressures imposed upon subgrade facilities will, therefore, be basically dependent upon the relative rigidity and movement of the backfilled structure. For active walls, such as retaining walls which can move outward (away from the backfill), drained backfill may be considered equivalent to a fluid with a density of 40 pounds per cubic foot in computing lateral pressures. For more rigid subgrade walls that are not more than 10 inches thick, granular backfill may be considered equivalent to a fluid with a density of 50 pounds per cubic foot. For very rigid

¹ “Report, Geotechnical Study, Proposed Spanish Fork Project, Approximately 800 West 4000 South, Spanish Fork, Utah” GSH Job No. 3898-001-24.

² “Report, Subsurface Soil Assessment - Observations, Spanish Fork Project – Subsurface Soil Assessment, Approximately 800 West 4000 South, Spanish Fork, Utah” GSH Job No. 3898-002-24.

non-yielding walls, granular backfill shall be considered equivalent to a fluid with a density of at least 60 pounds per cubic foot. The above values assume that the surface of the soils slope behind the wall is horizontal and that the granular fill within 3 feet of the wall will be compacted with hand-operated compacting equipment.

For seismic loading of below-grade walls, the uniform lateral pressures below, in pounds per square foot (psf), shall be added based on wall depth and wall case:

Uniform Lateral Pressures			
Wall Height (Feet)	Active Pressure Case (psf)	Moderately Yielding Case (psf)	At Rest/Non-Yielding Case (psf)
4	50	85	119
6	75	127	179
8	100	170	239
10	125	212	299

Subgrade Modulus

The subgrade modulus (k) of the natural clay soils encountered at the site is 70 pounds per cubic inch.

Closure

All other recommendations presented in the referenced report and assessment remain valid and shall continue to be followed.

If you have any questions or would like to discuss these items further, please feel free to contact us at (801) 685-9190.

Respectfully submitted,

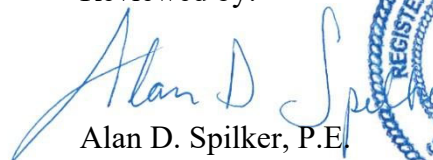
GSH Geotechnical, Inc.



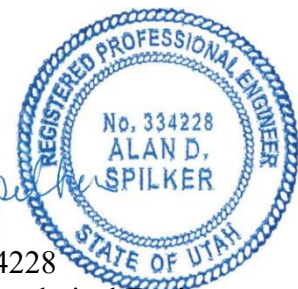
Nathan Wenger, E.I.T.
Staff Engineer

NW/ADS:jlh

Reviewed by:



Alan D. Spilker, P.E.
State of Utah No. 334228
President/Senior Geotechnical Engineer



cc: Mr. Mike Spagnolli (email)
Antunovich Associates

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Access to site.
 - 4. Work restrictions.
 - 5. Specification and drawing conventions.

1.03 PROJECT INFORMATION

- A. Project Identification: Tuffli Company – Phase 1 Spec Building.
 - 1. Project Location: 3652 N 1150 W – Spanish Fork, UT 84660.
- B. Owner: Tuffli Company – 2245 W 190th Street – Torrance, CA 90504.
- C. Architect: Antunovich Associates, 224 West Huron Street, Suite 7E, Chicago, Illinois 60654.
- D. Consultants: The Architect and the Owner have retained design professionals identified on the drawings, who have prepared designated portions of the Contract Documents.

1.04 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 - 1. The Project consists of a new 15,068 square foot, one story pre-engineered metal building, 32 feet in height, fully sprinklered that will serve as an Office facility with an attached Repair Garage for two future tenants, the building is demised at the centerline. The building's exterior enclosure is various profiles of metal wall and roof panels, overhead panel doors, aluminum storefront windows, and aluminum canopies above the entries. The building will be constructed on a cast in place reinforced concrete foundation. Site improvements include grading, asphalt site paving, stormwater control measures, underground utility services, site lighting, site fencing and vehicle access gates.
- B. Type of Contract:
 - 1. Project will be constructed under contract as established by Owner.

1.05 ACCESS TO SITE

- A. Use of Site: Limit use of Project site to areas permitted by law, permit, and the Contract Documents. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Driveways, Walkways and Entrances: Keep driveways, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.06 WORK RESTRICTIONS

- A. Work Restrictions - General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8 a.m. to 5 p.m., Monday through Friday, unless otherwise indicated in the Contract or directed by Owner.

1.07 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.
- D. Conflicts or Discrepancies: In the case of conflicts or discrepancies between Drawings and Divisions 02 - 49 of the Specifications, or within or among the Contract Documents and not clarified by Addendum or supplemental instruction, the Architect shall determine which takes precedence. Immediately on discovery of a conflict or discrepancy, Contractor shall prepare and submit a request for information (RFI) meeting requirements of Section 013100 "Project Management and Coordination."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances may include the following:
 - 1. Lump-sum allowances.
 - 2. Unit-cost allowances.
 - 3. Quantity allowances.
 - 4. Contingency allowances.
 - 5. Testing and inspecting allowances.
- C. Related Requirements:
 - 1. Section 012200 "Unit Prices" for procedures for using unit prices.
 - 2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.03 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.04 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.05 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.06 COORDINATION

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.07 LUMP-SUM, UNIT-COST, AND QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials included under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
 - 1. If requested by Architect, retain and prepare unused material for storage by Owner.
Deliver unused material to Owner's storage space as directed.

1.08 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.
- C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.
- D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.09 TESTING AND INSPECTING ALLOWANCES

- A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.
- B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.
- C. Costs of services not required by the Contract Documents are not included in the allowance.
- D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.10 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Unit Cost Allowances:
 - a. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 - b. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES

- A. Allowance No. X: To be determined.

END OF SECTION

SECTION 012200 - UNIT PRICES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.03 DEFINITIONS

- A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.04 PROCEDURES

- A. Unit prices include all required labor, necessary material, tools, equipment, plus cost for delivery, installation, insurance, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. Quantities indicated are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.
- E. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

1.05 MEASUREMENT OF QUANTITIES

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be verified by Owner.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement Devices:
 - 1. Weigh Scales: Inspected, tested and certified by the applicable state Weights and Measures department within the past year.
 - 2. Platform Scales: Of sufficient size and capacity to accommodate the conveying vehicle.
 - 3. Metering Devices: Inspected, tested and certified by the applicable state department within the past year.
- E. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- F. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

- G. Measurement by Area: Measured by square dimension using mean length and width or radius.
- H. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- I. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
- J. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Architect prior to starting work.
- K. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes, calculate and certify quantities for payment purposes.

1.06 PAYMENT

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.
- B. Payment will not be made for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required Work.
 - 5. Products remaining on hand after completion of the Work.
 - 6. Loading, hauling, and disposing of rejected Products.

1.07 DEFECT ASSESSMENT

- A. Replace Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct one of the following remedies:
 - 1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Owner.
- C. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.
- D. The authority of Owner to assess the defect and identify payment adjustment is final.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SCHEDULE OF UNIT PRICES

- A. General: General: See other Contract Documents, including individual Specification sections and Drawings, for descriptions and requirements of work requiring unit prices.
- B. Unit Price No. 1 - Substrate Remediation:
 - 1. Description: Remediation of flooring substrates due to unacceptable moisture or pH conditions as specified in Section 090561.13 "Moisture Vapor Emission Control".
 - 2. Unit of Measurement: Cost per square foot.
- C. Unit Price No. X: To be determined.

END OF SECTION

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.03 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.04 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
 - 2. Include as part of each alternate costs of related coordination, modification, or adjustment as necessary to completely integrate work of the alternate into Project.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 SCHEDULE OF ALTERNATES

- A. Alternate No. X: To be determined.

END OF SECTION

SECTION 012500 - SUBSTITUTION PROCEDURES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for products selected under an allowance.
 - 2. Section 012300 "Alternates" for products selected under an alternate.
 - 3. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.03 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.04 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.

- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.05 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.06 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

- A. General:
- 1. Upon the written request or direction of Owner, Architect shall evaluate and advise Owner with respect to proposed or requested changes in materials, products, or equipment. Architect shall be entitled to rely on the accuracy and completeness of the information provided in conjunction with the requested substitution. Architect shall not be responsible for errors, omissions, or inconsistencies in information by others or in any way resulting from incorporating such substitution into the Project.
 - 2. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- B. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.

- c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.
 - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)**END OF SECTION**



SUBSTITUTION REQUEST

(During the Bidding/Negotiating Stage)

Project: _____ Substitution Request Number: _____

From: _____

To: _____ Date: _____

A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

A/E's REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- ☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- ☐ Substitution rejected - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed by: _____

Date: _____

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____



SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

From: _____
To: _____ Date: _____

A/E Project Number: _____
Re: _____ Contract For: _____

Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone: _____
Trade Name: _____ Model No.: _____
Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item: _____

Similar Installation:

Project: _____ Architect: _____
Address: _____ Owner: _____
_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitution: _____ (\$ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase — Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: ☐

A/E's REVIEW AND RECOMMENDATION

- ☐ Approve Substitution - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- ☐ Approve Substitution as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
- ☐ Reject Substitution - Use specified materials.
- ☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

OWNER'S REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures. Prepare Change Order.
- ☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures. Prepare Change Order.
- ☐ Substitution rejected - Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.03 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.04 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

1.05 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.06 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.07 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 012900 - PAYMENT PROCEDURES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 4. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.03 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703.
 - 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.

- f. Change Orders (numbers) that affect value.
- g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
- 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
- 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
- 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
- 7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- 8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
- 9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
- 10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.05 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- E. **Stored Materials:** Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. **Transmittal:** Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. **Waivers of Mechanic's Lien:** With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. **Waiver Forms:** Submit executed waivers of lien on forms acceptable to Owner.
- H. **Initial Application for Payment:** Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
 13. Certificates of insurance and insurance policies.
 14. Performance and payment bonds.
 15. Data needed to acquire Owner's insurance.
- I. **Application for Payment at Substantial Completion:** After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Requests for Information (RFIs).
 - 3. Digital project management procedures.
 - 4. Project meetings.
- B. Related Requirements:
 - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.04 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.05 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.06 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor 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 of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

- a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: CSI Form 13.2A.
 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 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 012600 "Contract Modification Procedures."
 - a. 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.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B. Include the following:
 1. Project name.
 2. Name and address of Contractor.
 3. Name and address of Architect.
 4. RFI number including RFIs that were returned without action or withdrawn.
 5. RFI description.
 6. Date the RFI was submitted.
 7. Date Architect's response was received.
- F. 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 seven days if Contractor disagrees with response.
 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
 2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.07 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals and during construction, unless specifically requested by Contractor and approved by Architect, and with execution of data licensing agreement.
 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
 3. Digital Drawing Software Program: Coordinate software with Architect.
 5. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
 - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.08 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.
 - d. Designation of key personnel and their duties.
 - e. Lines of communications.
 - f. Procedures for processing field decisions and Change Orders.
 - g. Procedures for RFIs.
 - h. Procedures for testing and inspecting.
 - i. Procedures for processing Applications for Payment.
 - j. Distribution of the Contract Documents.
 - k. Submittal procedures.
 - l. Preparation of record documents.
 - m. Use of the premises.
 - n. Work restrictions.
 - o. Working hours.
 - p. Owner's occupancy requirements.
 - q. Responsibility for temporary facilities and controls.
 - r. Procedures for moisture and mold control.
 - s. Procedures for disruptions and shutdowns.
 - t. Construction waste management and recycling.
 - u. Parking availability.
 - v. Office, work, and storage areas.
 - w. Equipment deliveries and priorities.
 - x. First aid.
 - y. Security.
 - z. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of record documents.

- b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.
 - f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Coordination of separate contracts.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. Responsibility for removing temporary facilities and controls.
 - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at regular intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 1) Review schedule for next period.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
 - 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

5. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION



REQUEST FOR INTERPRETATION

Project: _____

R.F.I. Number: _____

From: _____

To: _____

Date: _____

A/E Project Number: _____

Re: _____

Contract For: _____

Specification Section: _____

Paragraph: _____

Drawing Reference: _____

Detail: _____

Request:

Signed by: _____

Date: _____

Response:

☐ Attachments

Response From: _____

To: _____

Date Rec'd: _____

Date Ret'd: _____

Signed by: _____

Date: _____

Copies: ☐ Owner ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ File

**ANTUNOVICH ASSOCIATES**

ARCHITECTURE • PLANNING • INTERIOR DESIGN

Chicago, Washington DC

Electronic File Transfer Agreement

PROJECT:**DATE:****AA PROJECT NUMBER:****FILE NAME:****ARCHITECT:****ANTUNOVICH ASSOCIATES**

224 West Huron Street, Suite 7E

Chicago, Illinois 60654

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Please return the original signed copy of this letter so that the electronic file can be released.

ACCEPTED BY:**TITLE:****COMPANY:****PHONE:****ADDRESS:****E-MAIL:****SIGNATURE:****DATE:**

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.
 - 5. Special reports.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

1.03 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.
- H. Special Reports: Submit at time of unusual event.
- I. Qualification Data: For scheduling consultant.

1.04 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS**2.01 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL**

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work under More Than One Contract: Include a separate activity for each contract.
 - 3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date.
 - 5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date.
 - 6. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
 8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

- C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.
- H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.
1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
 2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
 3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
 4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
 - b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.03 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.

14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.04 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
 - 2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
 - 3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.03 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each . Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 12 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 - 3. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.04 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS**2.01 PHOTOGRAPHIC MEDIA**

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 10 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION**3.01 CONSTRUCTION PHOTOGRAPHS**

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- C. Preconstruction Photographs: Before commencement of excavation, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction. Photos to include overall and detailed images including focus on existing damage or irregularities.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- E. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- F. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
 - 1. Three days' notice will be given, where feasible.
 - 2. In emergency situations, take additional photographs within 24 hours of request.
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Substantial Completion of a major phase or component of the Work.
 - d. Extra record photographs at time of final acceptance.
 - e. Owner's request for special publicity photographs.

END OF SECTION

SECTION 013300 - SUBMITTAL PROCEDURES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.03 DEFINITIONS

- A. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- B. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.04 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 - 3. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.

- j. Activity or event number.

1.05 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals, unless specifically requested by Contractor and approved by Architect, and with execution of data licensing agreement.
1. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 2. Digital Drawing Software Program: Coordinate software with Architect.
 3. Contractor shall execute a data licensing agreement in the form of Architect's standard digital data licensing agreement..
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner and Architect, containing the following information:

- a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
- a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

- a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 4. Color and Finish Samples: Do not submit color and finish samples only electronically. Submit actual samples for review by Architect.
 5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
 7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- T. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- V. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- X. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
 - 1. Preparation of substrates.
 - 2. Required substrate tolerances.
 - 3. Sequence of installation or erection.
 - 4. Required installation tolerances.
 - 5. Required adjustments.

6. Recommendations for cleaning and protection.
- Y. Manufacturer's Technical Representative's Field Reports: Comply with requirements specified in Section 014000 "Quality Requirements."
- Z. Factory-Authorized Service Representative's Reports: Comply with requirements specified in Section 014000 "Quality Requirements."
- AA. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- BB. Material Safety Data Sheets (MSDS): Submit information directly to Owner; do not submit to Architect.
 1. Architect will not review submittals that include MSDS and will return the entire submittal for resubmittal.

2.02 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

- A. General: Architect shall review and take appropriate action on required Contractor submittals such as shop drawings, product data, equipment specifications, samples and other data specified in this Section, but only for the limited purpose of checking for conformance with the design concept and the information shown in the Contract Documents. Architect shall not be responsible for the accuracy or completeness of details, such as quantities, dimensions, weights, fabrication, means, methods, sequencing, coordination with other trades, or safety, all of which are the sole responsibility of the Contractor. Review of a specific item shall not indicate that the Architect has reviewed the entire assembly or its components. Contractor shall remain solely responsible for compliance with the Contract Documents and manufacturer's instructions except as expressly permitted in writing.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect .
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION

SECTION 014000 - QUALITY REQUIREMENTS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.

1.03 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.04 REFERENCES AND STANDARDS

- A. General: See Section 014200 "References".

1.05 CONFLICTING REQUIREMENTS

- A. General: Comply with specified standards as minimum quality for the Work, except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship. Refer uncertainties to Architect for a decision before proceeding.
- B. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
 - 1. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
- D. Manufacturer's Instructions: Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

1.06 ACTION SUBMITTALS

- A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.07 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Contractor's quality-control personnel.
- B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.

2. Entity responsible for performing tests and inspections.
 3. Description of test and inspection.
 4. Identification of applicable standards.
 5. Identification of test and inspection methods.
 6. Number of tests and inspections required.
 7. Time schedule or time span for tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.08 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspectng.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
 - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

1.09 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections;
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.

- b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
 - f. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.
2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
- 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
 - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 7. Demolish and remove mockups when directed unless otherwise indicated.

1.10 QUALITY CONTROL

- A. General: Inspections, tests, evaluations and related actions specified in this section, other specification sections, and indicated elsewhere in Contract Documents are not intended to limit Contractor's own quality assurance and control programs and procedures which facilitate overall compliance with requirements of Contract Documents. Contractor shall provide own quality assurance and control programs and procedures to assure the Work meets requirements of Contract Documents, whether specified or not.
- B. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
- 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- C. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
- 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

- a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
 7. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, start-up of equipment, testing, adjusting and balancing, and submittal of written reports. Submit qualifications to Owner and Architect 30 days prior to required observations.
- F. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- G. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform any duties of Contractor.
- H. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.

- I. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- J. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
 - 6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 GENERAL

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
 - 5. Any other information required by authorities having jurisdiction.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 REPLACEMENT, REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.
- D. Replace Work or portions of the Work not conforming to specified requirements. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 014200 - REFERENCES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Product": Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- I. "Project Manual": The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- J. "Provide": Furnish and install, complete and ready for the intended use.
- K. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
- L. "Supply": Same as Furnish.

1.03 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated or required by applicable codes.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- D. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

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

1.04 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.03 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.04 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.05 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.06 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS**2.01 TEMPORARY FACILITIES**

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Locate offices a minimum distance of 30 feet from existing and new structures.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Space of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish space with conference table, chairs, and 4-foot-square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Coffee machine and supplies.
 - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.02 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures".

PART 3 - EXECUTION**3.01 INSTALLATION, GENERAL**

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Use trigger-operated nozzles for water hoses, to avoid waste of water.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Provide at time of project mobilization.
 - 2. Maintain daily in clean and sanitary condition.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
 - 1. Provide additional telephone lines for the following:
 - a. Provide minimum of one dedicated fax machine/printer and a dedicated telephone line for each facsimile machine in each field office; or fax-to-email software on field office computer.
 - 2. At each telephone, post a list of important telephone numbers.
 - a. Police and fire departments.
 - b. Ambulance service.
 - c. Contractor's home office.
 - d. Contractor's emergency after-hours telephone number.
 - e. Architect's office.
 - f. Engineers' offices.
 - g. Owner's office.
 - h. Principal subcontractors' field and home offices.
 - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

- J. Electronic Communication Service: Provide a windows-based computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications, with necessary software and laser printer. Equip computer with not less than the following:
1. Internet Service: Cable modem or faster, router and ISP, equipped with hardware firewall.
 2. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.

3.03 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 31 "Earthwork" sections for earth moving.
 3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
 2. Protect existing site improvements to remain including curbs, pavement, and utilities.
 3. Coordinate access and haul routes with governing authorities.
 4. Maintain access for fire-fighting equipment and access to fire hydrants.
 5. Provide means of removing mud from vehicle wheels before entering streets.
- D. Parking: Provide temporary parking areas for construction personnel. When site space is not adequate, provide additional off-site parking.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as directed by Owner. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs as directed by Owner.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touchup signs so they are legible at all times.

- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
1. Provide containers with lids. Remove trash from site periodically.
 2. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
 3. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
- H. Construction Aids:
1. General:
 - a. Provide and maintain temporary construction aids such as stairs, ladders, ramps, scaffolds, hoists, runways, derricks, chutes and like items as necessary to facilitate execution of the Work.
 - b. Apparatus, equipment and other construction aids shall meet codes, regulations and requirements of public and other authorities having jurisdiction over the Work and requirements of insurance and trade union authorities.
 - c. Be responsible for adequacy and strength of construction aids, and for damage and injury caused by insufficiency of construction aids.
 - d. Protect existing and new conditions and permanent work from damage, defacement and loss of service resulting from construction aids.
 2. Shoring and Bracing:
 - a. Provide and maintain temporary shoring and bracing as necessary to protect against movement or settlement of existing and new conditions, improvements or construction and for safety and health of personnel and public. Maintain shoring and bracing in a stable and safe condition.
 - b. Shoring and bracing shall be designed, certified, reviewed and inspected by engineer of Contractor.
 3. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - a. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
 - b. Hoisting and anchoring facilities and apparatus, including attachments, shall be designed, certified, reviewed and inspected by engineer of Contractor.
- I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- J. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.

2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains, and to prevent flow of stormwater onto adjacent properties.
1. Maintain Project site, excavations, and construction free of standing water.
 2. Manage and dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
 3. Remove snow and ice as required to minimize accumulations.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- G. Site Enclosure Fence: Before construction 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.
1. Construction: Contractor's option meeting rules and regulations of authorities having jurisdiction, but at minimum 6 feet high equipped with vehicular and pedestrian gates with locks.
 2. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 3. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- K. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
1. Construct covered walkways using scaffold or shoring framing.
 2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 3. Paint and maintain appearance of walkway for duration of the Work.
- L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
 2. Provide access doors with self-closing hardware and locks.

- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.05 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace, or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use permanent HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
 - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
 - c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.06 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 - 2. Clean and repair damage caused by installation or use of temporary work.
 - 3. Restore existing facilities used during construction to original condition.
 - 4. Restore new permanent facilities used during construction to specified condition.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION

SECTION 016000 - PRODUCT REQUIREMENTS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
 - 2. Section 014200 "References" for applicable industry standards for products specified.

1.03 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.04 ACTION SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 15 days after date of Agreement.
 - 2. For products specified only by reference standards, list applicable reference standards.
 - 3. Statement indicating why specified material or product cannot be provided.
- B. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

- a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Product Data, Shop Drawings, Test Reports and Samples Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
- 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time 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 Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
 - 5. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
 - 6. Arrange for the return of packing materials, such as wood pallets, where economically feasible.
- C. Storage and Protection:
- 1. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
 - 2. Store and protect products in accordance with manufacturers' instructions
 - 3. Store with seals and labels intact and legible.
 - 4. Store products to allow for inspection and measurement of quantity or counting of units. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.
 - 5. Prevent contact with material that may cause corrosion, discoloration, or staining.
 - 6. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
 - 7. Store materials in a manner that will not endanger Project structure.
 - 8. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 9. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 10. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 11. Protect stored products from damage and liquids from freezing.
 - 12. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
 - 13. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

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

1.07 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Design Basis for Systems and Products:
 - a. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 - b. Information included on drawings and in specifications establishes a basis of aesthetics and performance for specified products and systems, and is indicated by dimensions, arrangements, alignment, orientation, and profiles related to sightlines, components within the systems themselves and adjacent construction. Aesthetic effect or appearance shall not be changed without prior acceptance of Architect. If changes are desired, submit complete set of drawings, if applicable, data and written explanation for proposed changes.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:

- a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
- 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered, unless otherwise indicated.
- 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 PRODUCTS - GENERAL

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Provide interchangeable components of the same manufacture for components being replaced.
- C. Motors: Refer to mechanical and electrical sections, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.
- D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- E. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.03 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

2.04 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

2.05 OWNER/TENANT SUPPLIED PRODUCTS

- A. Owner's/Tenant's Responsibilities:
 1. Arrange for and deliver Owner/Tenant reviewed shop drawings, product data, and samples, to Contractor.
 2. Arrange and pay for product delivery to site.
 3. On delivery, inspect products jointly with Contractor.
 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
 1. Review Owner/Tenant reviewed shop drawings, product data, and samples.
 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner/Tenant.
 3. Handle, store, install and finish products.
 4. Repair or replace items damaged after receipt.

2.06 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 017300 - EXECUTION**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for limits on use of Project site.
 - 2. Section 013300 "Submittal Procedures" for submitting surveys.
 - 3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
 - 4. Section 078400 "Firestopping" for patching penetrations in fire-rated construction.

1.03 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor. Submit name, address, and telephone number of Surveyor before starting survey work.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Requests:
 - 1. Submit written request at least 10 days in advance of cutting or alteration that affects:
 - a. Structural integrity of any element of Project.
 - b. Integrity of weather exposed or moisture resistant element.
 - c. Efficiency, maintenance, or safety of any operational element.
 - d. Visual qualities of sight exposed elements.
 - e. Work of Owner or separate Contractor, if applicable.
 - 2. Request shall include the following:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting or alteration.
 - d. Description of proposed work and products to be used.
 - e. Alternatives to cutting and patching.
 - f. Effect on work of Owner or separate Contractor, if applicable.
 - g. Written permission of affected separate Contractor.

- h. Date and time work will be executed.
- D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.
- E. Survey Logs: Submit survey logs for the project record.
- F. Certified Surveys: Submit, signed by land surveyor.
 - 1. On request, submit documentation verifying accuracy of survey work.
- G. Final Property Survey: Submit showing the Work performed and record survey data.
 - 1. Utilities: Accurately record actual locations of capped and active utilities.

1.05 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.
- B. Professional Engineer: For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in jurisdiction where the Work is located.
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
 - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
 - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Fire separation assemblies.
 - c. Air or smoke barriers.
 - d. Fire-suppression systems.
 - e. Mechanical systems piping and ducts.
 - f. Control systems.
 - g. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
 - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
 - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 3. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
 4. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 5. Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
 2. List of detrimental conditions, including substrates.
 3. List of unacceptable installation tolerances.
 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- 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 other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis-fabrication.
- 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 caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."
- E. Preparation of Substrates:
 - 1. Clean substrate surfaces prior to applying next material or substance.
 - 2. Seal cracks or openings of substrate prior to applying next material or substance.
 - 3. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.04 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.

- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.05 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
 - 2. Make vertical work plumb and make horizontal work level.
 - 3. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 4. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 5. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
 - 6. Use of explosives is not allowed.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later
- C. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- D. Notify affected utility companies and comply with their requirements.
- E. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- F. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

- G. 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.
- H. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- I. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- J. 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.
- K. Shoring and Bracing: For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in jurisdiction where the Work is located.
- L. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- M. Joints: 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.
- N. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- O. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- P. Make neat transitions between different surfaces, maintaining texture and appearance.
- Q. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- R. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- S. Coordinate completion and clean-up of work of separate sections.
- T. Use products, cleaners, and installation materials that are not considered hazardous.
- U. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

3.06 CUTTING AND PATCHING

- A. General: Whenever possible, execute the work by methods that avoid cutting or patching.
 - 1. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 2. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.

- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
 - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 6. Proceed with patching after construction operations requiring cutting are complete.
- F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

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 timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.08 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. 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 waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- 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: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls".
- 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.

3.09 STARTING AND ADJUSTING

- A. Notify Owner and Architect and owner seven days prior to start-up of each item.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- G. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- H. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- I. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation. Comply with qualification requirements in Section 014000 "Quality Requirements."
- J. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
 - 1. Provide special protection where specified in individual specification sections.
 - 2. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- B. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- C. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- D. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- E. Prohibit traffic from landscaped areas.
- F. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.
- G. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 017300 "Execution" for progress cleaning of Project site.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.03 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.04 CLOSEOUT SUBMITTALS

- A. Authorities Having Jurisdiction Submittals: Provide submittals that are required by authorities having jurisdiction. Provide copies to Owner and Architect.
- B. Certificates of Release: From authorities having jurisdiction.
- C. Certificate of Insurance: For continuing coverage.
- D. Field Report: For pest control inspection.

1.05 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.06 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit written certification that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's review.
 3. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 4. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 5. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 6. Submit test/adjust/balance records.
 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.07 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."

2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.08 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect will return annotated file.

1.09 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal:
1. For products, equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
1. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 2. Verify that documents are in proper form, contain full information, and are notarized.
 3. Identify on cover sheet with title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
 4. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

- C. Insert copy of each warranty into operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations with non-hazardous cleaning materials and meeting local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean debris from roofs, gutters, downspouts, and drainage systems.
 - g. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - h. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - i. Sweep concrete floors broom clean in unoccupied spaces.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent. Do not remove, paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
 - m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
 - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - r. Leave Project clean and ready for occupancy.

- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls" .

3.02 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 017823 - OPERATION AND MAINTENANCE DATA**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. 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. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.03 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.

1.04 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 10 days of receipt of Architect's comments and prior to commencing demonstration and training.
 - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within 10 days after acceptance.

PART 2 - PRODUCTS**2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY**

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. 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. Tables 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 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 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- 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: 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 and contact information for Contractor.
 - 6. Name and contact information for Architect.
 - 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 8. 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 content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. 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, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

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 OPERATION 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. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has 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. Use designations for products indicated on Contract Documents.
 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. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.05 PRODUCT MAINTENANCE MANUALS

- 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, 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 and drawing or schedule designation or identifier where applicable.
- 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. Reordering 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.

2.06 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- 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 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 and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard 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 video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled 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: Include 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.
- 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 a complete set of emergency information indicating procedures for use by emergency personnel and by 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. Manufacturers' 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 Section 017839 "Project Record Documents."
- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 017839 - PROJECT RECORD DOCUMENTS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 017300 "Execution" for final property survey.
 - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.03 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints.
 - 2) Include each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS**2.01 RECORD DRAWINGS**

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

- b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Changes made by addenda, substitutions, and alternates utilized.
 - m. Details not on the original Contract Drawings.
 - n. Field records for variable and concealed conditions.
 - o. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Organization and Identification: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Include identification on cover sheets.
 2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 5. Note substitutions, alternates utilized, addenda, Change Orders, record Product Data, and record Drawings where applicable.

2.03 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.

2.04 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 017900 - DEMONSTRATION AND TRAINING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Landscape irrigation.
 - 6. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Fixtures and fittings.
 - 4. Items specified in individual product Sections.

1.03 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
 - 2. Submit not less than 4 weeks prior to start of training.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.04 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Date of video recording.
 - 2. At completion of training, submit complete training manual(s) for Owner's use prepared in same PDF file format required for operation and maintenance manuals specified in Section 017823 "Operation and Maintenance Data."

1.05 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- B. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
 - 1. Inspect and discuss locations and other facilities required for instruction.
 - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 - 3. Review required content of instruction.
 - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.06 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- 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 have been reviewed and approved by Architect.

1.07 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- 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, include instruction for the following as applicable to the system, equipment, or component:
 - 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. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. 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. Instruction 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.

1.08 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.09 INSTRUCTION

- A. 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.
- B. 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 with at least seven days' advance notice.

- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- 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.

1.10 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include 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.
- B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full HD mode with vibration reduction technology.
 - 1. Submit video recordings.
 - 2. File Hierarchy: Organize folder structure and file locations according to Project Manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
 - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged according to Project Manual table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. Email address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
 - 1. Film training session(s) in segments not to exceed 15 minutes.
 - a. Produce segments to present a single significant piece of equipment per segment.
 - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
 - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
 - 1. Furnish additional portable lighting as required.
- E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- F. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 033546 - PENETRATING LIQUID CONCRETE FLOOR TREATMENTS

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 penetrating liquid concrete floor treatments, such as sealers, densifiers, and hardeners, including:
 - 1. Penetrating liquid densifier and sealer.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with penetrating liquid concrete floor treatments to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Cast-in-place concrete subcontractor.
 - e. Concrete finishing Subcontractor.
 - 2. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of concrete.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's printed statement of VOC content.
 - 2. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Repair materials.
 - 2. Liquid floor treatments.
- C. Installer Certificate: Provide certificate signed by manufacturer or installer certifying that specified floor treatment has been installed meeting requirements, instructions and recommendations of manufacturer.
- D. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.06 FIELD CONDITIONS

- A. Environmental Conditions: Maintain ambient temperature and environmental conditions as recommended by manufacturer.
- B. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
 2. Building has been closed in for not less than 30 days before treating wall assemblies.
 3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
 4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
 5. Rain or snow is not predicted within 24 hours.
 6. Not less than time period recommended by manufacturer has passed since surfaces were last wet.
 7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.
- C. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- D. Adjacent Surfaces: Protect materials and surfaces adjacent or near surfaces to receive products from contamination, damage or defacement.

PART 2 - PRODUCTS

2.01 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Densifier and Sealer: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.

2.02 MISCELLANEOUS MATERIALS

- A. Cleaning Agent: Heavy duty concrete floor cleaner and stripper as recommended by water repellent manufacturer; non-etching; for removing curing compounds, oils, grease sealers and other contaminants prior to application of water repellents.
1. Basis-of-Design Product: Subject to compliance with requirements, provide The Euclid Chemical Company; Euco Clean & Strip, or comparable product as recommended by floor treatment manufacturer:
 - a. BASF Construction Chemicals - Building Systems.
 - 1) Euclid Chemical Company (The), an RPM company.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.
1. Verify that floor surfaces are acceptable to receive the work of this section per manufacturer's recommendations.
 2. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.
 3. Verify surfaces are solid, dry and free of frozen matter, loose particles, cracks, pits, laitance, curing compounds and foreign matter that would impair, interfere or otherwise affect application and performance of products, and appearance of substrate surface.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation shall indicate acceptance of conditions.

3.02 PREPARATION

- A. General: Prepare surfaces meeting instructions and recommendations of manufacturer.
- B. Testing: Test substrates for temperature and moisture content meeting instructions of product manufacturer to ensure surfaces are within required conditions for application of product.
- C. Cleaning: Clean surfaces of substances so as not to impair or interfere with application, penetration and performance of product and not to entrain impurities, stain or otherwise affect surface with application of product. Clean substrate surfaces using materials and methods recommended by manufacturer.
- D. Crack Repair: Repair cracks over 5 mils wide with injection resin epoxy or joint sealant as applicable to manufacturer. Cure of crack tuckpointing shall be of duration as instructed by manufacturer, but not less than 3 days.
- E. Protection: Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

3.03 LIQUID FLOOR TREATMENTS

- A. Apply materials meeting instructions and recommendations of manufacturer.
- B. Meet instructions and recommendations of manufacturer for coverage rates and application methods.
- C. Coordinate coverage rates and application methods with applicable final reviewed project site mock-up construction.
- D. Remove excess product and residue as required by manufacturer.

3.04 CLEANING AND PROTECTION

- A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.
- B. Clean treated surfaces meeting instructions and recommendations of manufacturer to remove any remaining residue.

END OF SECTION

SECTION 042000 - UNIT MASONRY**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. Concrete masonry units.
 - 2. Decorative concrete masonry units.
 - 3. Mortar and grout.
 - 4. Steel reinforcing bars.
 - 5. Masonry-joint reinforcement.
 - 6. Ties and anchors.
 - 7. Miscellaneous masonry accessories.
- B. Related Requirements:
 - 1. Division 05 "Metals," structural steel framing section for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.

1.03 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site before starting work of this section to review conditions associated installation of unit masonry. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include Owner, Architect, Contractor, installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant. Discussions shall include but not be limited to the following:
 - 1. Structural concepts and any special masonry details.
 - 2. Locations of expansion and control joints.
 - 3. Standard of workmanship and quality control requirements.
 - 4. Construction and substrate conditions.
 - 5. Surface preparation and finish requirements for concrete masonry units to receive air and weather barriers and elastomeric coatings.
 - 6. Review different sealant and mortar color locations.
 - 7. Environmental conditions.
 - 8. Special coordination items.
 - 9. Code required testing of reinforced masonry.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
 - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
 - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

1.06 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of the following:

1. Masonry units.
 - a. Include material test reports substantiating compliance with requirements.
 - b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
 2. Integral water repellant used in CMUs.
 3. Cementitious materials. Include name of manufacturer, brand name, and type.
 4. Mortar admixtures.
 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 6. Grout mixes. Include description of type and proportions of ingredients.
 7. Reinforcing bars.
 8. Joint reinforcement.
 9. Anchors, ties, and metal accessories.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602.
- D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Installer of unit masonry shall specialize in installation of unit masonry assemblies with minimum 5 years experience, and shall have completed 5 project minimum of size and complexity similar to the work. Provide proof of qualifications.
1. Grouting and Reinforcing: All masonry grouting and reinforcing work shall be performed by masonry craftworkers who have successfully completed the International Masonry Institute training course for Grouting and Reinforced Masonry Construction, or equal.

1.08 COORDINATION

- A. Concrete Reinforcement Coordination: Coordinate reinforcement in concrete and any required mechanical anchorage prior to post-tensioned concrete slabs being performed. X-ray surveying of slabs after concrete work is completed for coordination of work of this Section will be at the expense of the installer.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.10 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
 - 2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.02 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
 - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.03 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
 - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent as follows:
 - 1. Locations:
 - a. Concrete masonry units in exterior walls and construction exposed to weather.
 - b. Concrete masonry units in blind side, property line applications.
 - c. Where indicated.
 - 2. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) ACM Chemistries; RainBloc.
 - 2) BASF Construction Chemicals - Building Systems; MasterPel 240.
 - 3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.
- C. CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: As indicated on Structural Drawings.
 - 2. Density Classification: As indicated on Structural.
 - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
- D. Decorative CMUs: ASTM C 90.
 - 1. Unit Compressive Strength: As indicated on Drawings.
 - 2. Density Classification: As indicated on Structural Drawings.
 - 3. Size: 8 inches by 8 inches by 16 inches.
 - 4. Pattern and Texture:
 - a. Standard pattern, split-face finish.

2.04 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
 - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- D. Mortar Cement: ASTM C 1329/C 1329M.
- E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Davis Colors; True Tone Mortar Colors.
 - b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
 - c. Solomon Colors, Inc.; SGS Mortar Colors.
- F. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

3. White-Mortar Aggregates: Natural white sand or crushed white stone.
 4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- G. Aggregate for Grout: ASTM C 404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals - Building Systems; Trimix-NCA.
 - b. Euclid Chemical Company (The); Accelguard 80.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ACM Chemistries; RainBloc for Mortar.
 - b. BASF Corporation, Construction Chemicals; MasterPel 240.
 - c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.
- J. Water: Potable.

2.05 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
 - b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
 - c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
1. Interior Walls: Hot-dip galvanized carbon steel.
 2. Exterior Walls: Hot-dip galvanized carbon steel.
 3. Wire Size for Side Rods: Minimum 0.148-inch diameter for single wythe joint reinforcement, and minimum 0.187-inch for multi-wythe joint reinforcement.
 4. Wire Size for Cross Rods: Minimum 0.148-inch diameter.
 5. Wire Size for Veneer Ties: Minimum 0.148-inch for tab type and eye type adjustable units, and minimum 0.187-inch diameter for pintle type adjustable units.
 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
 7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

2.06 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
 2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 3. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.

4. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 5. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 6. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
 7. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
 2. Tie Section: Triangular-shaped wire tie made from minimum 0.187-inch- diameter, hot-dip galvanized steel wire.
 3. Mill Galvanized Wire: Mill-galvanized wire ties may be used in interior walls, as acceptable to Architect. Use of mill-galvanized wire is not allowed in spaces where humidity is expected to exceed 75 percent.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from minimum 0.060-inch- thick steel sheet, galvanized after fabrication.
 - a. Minimum 0.064-inch-thick, galvanized-steel sheet may be used at interior walls, as acceptable to Architect. Use is not allowed in spaces where humidity is expected to exceed 75 percent.
 2. Tie Section: Triangular-shaped wire tie made from minimum 0.187-inch- diameter, hot-dip galvanized steel.
 - a. Mill Galvanized Wire: Mill-galvanized wire ties may be used in interior walls, as acceptable to Architect. Use of mill-galvanized wire is not allowed in spaces where humidity is expected to exceed 75 percent.
- E. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M or epoxy coating 0.020 inch thick.

2.07 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805, or PVC, complying with ASTM D2287, Type PVC-65406; and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.08 MASONRY CLEANERS

- A. Masonry Cleaners: As recommended in writing by unit masonry manufacturer, for removing mortar/grout stains, efflorescence and other new constructions stains from new masonry without discoloring or damaging masonry surfaces and mortar. Use products expressly approved for intended use by cleaner manufacturer, and masonry units being cleaned.

2.09 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Use portland cement-lime mortar, or unless otherwise indicated.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For reinforced masonry, use Type S
 - 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
 - 4. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.
 - 2. Pigments shall not exceed 5 percent of or mortar cement by weight.
 - 3. Mix to match Architect's sample.
 - 4. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match Architect's sample.
 - 2. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:
 - a. Decorative CMUs.
- F. Grout for Unit Masonry: Comply with ASTM C 476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
 - 3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that impair mortar bond.

- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.03 TOLERANCES

- A. Dimensions and Locations of Elements:
 - 1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
 - 2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
 - 3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.
- B. Lines and Levels:
 - 1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
 - 2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
 - 3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
 - 4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
 - 5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
 - 6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
 - 7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.
- C. Joints:
 - 1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
 - 2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
 - 3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
 - 4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond, unless otherwise indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated. Between top of full height walls and partitions, and structure above, provide void space to compensate for deflection of above structure
 1. Install compressible filler in joint between top of partition and underside of structure above.
 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078400 "Firestopping."

3.05 MORTAR BEDDING AND JOINTING

- A. Lay CMUs as follows:
 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- E. Cut joints flush where indicated to receive cavity wall insulation, weather barriers, and air barriers unless otherwise indicated.

3.06 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings, in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.07 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
 - 1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
 - 2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
 - 3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.08 CONTROL AND EXPANSION JOINTS

- A. General: Provide control joints in concrete unit masonry aligned with openings and joints in related work as applicable, meeting recommendations indicated in NCMA - Technical Note TEK 10-2A - Control Joints for Concrete Masonry Walls, and as indicated by final reviewed shop drawings. In addition, before start of work review location of all joints with Architect.
- B. Install control- and expansion-joint materials in unit masonry as masonry progresses.
- C. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- D. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.09 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
 - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.10 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections in accordance with Level 2 in TMS 402.
 1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
 2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
 3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Testing Prior to Construction - Non-Essential Facilities: One set of tests.
- D. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.11 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
 4. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

END OF SECTION

SECTION 055000 - METAL FABRICATIONS**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. Steel framing and supports for overhead doors.
 - 2. Steel framing and supports for countertops.
 - 3. Steel tube reinforcement for low partitions.
 - 4. Steel framing and supports for mechanical and electrical equipment.
 - 5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 6. Metal ladders.
 - 7. Structural-steel door frames.
 - 8. Miscellaneous steel trim including steel angle corner guards steel edgings.
 - 9. Metal bollards.
 - 10. Loose bearing and leveling plates for applications where they are not specified in other Sections.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
 - 2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements:
 - 1. Division 03 "Concrete" cast-in-place concrete section for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
 - 2. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
 - 3. Division 05 "Metals" structural steel framing section.

1.03 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Weld Plates: Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Paint products.
 - 2. Grout.

- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for overhead doors.
 2. Steel framing and supports for countertops.
 3. Steel tube reinforcement for low partitions.
 4. Steel framing and supports for mechanical and electrical equipment.
 5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 6. Metal ladders.
 7. Structural-steel door frames.
 8. Miscellaneous steel trim including steel angle corner guards steel edgings.
 9. Metal bollards.
 10. Barrier cable systems.
 11. Pipe guards.
- C. Delegated-Design Submittal: For miscellaneous steel framing and supports, countertop framing and supports, tube framing for partial height walls, and ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator and professional engineer.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum 5 years of documented experience. Upon request, provide proof of qualifications.
- B. Installer Qualifications: Company shall be same firm that fabricated respective items.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.07 PRODUCT HANDLING

- A. Shop Assembly: Fabricate and assemble work in shop to greatest extent possible, minimizing amount of work to be completed at project site.
- B. Storage: Store and handle materials as required to prevent damage and structural weakening.
- C. Pre-Finished Materials: Store and handle pre-finished materials as required to protect finish from damage. Repair any damaged materials meeting requirements of Article - Adjusting and Cleaning of this section.

1.08 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design elevator related metal fabrications, miscellaneous steel framing and supports, countertop framing and supports, tube framing for partial height walls, and ladders.

- B. Countertop Framing: Provide countertop framing capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections or of exhibiting excessive deflections in any of the components making up the countertops and vanities:
 - 1. Dead Loads: All countertop dead loads.
 - 2. Live Loads: 500 pound live load placed on the countertop/vanity.
 - 3. Deflection: Not to exceed $L/1000$ times the span or 1/8 inch, whichever is less.
- C. Tube Framing for Partial Height Walls: Provide tube framing for partial height walls capable of withstanding a deflection not to exceed $2L/1440$ of the wall height when subjected to a positive and negative pressure of 5 psf.
- D. Structural Performance of Aluminum Ladders: Aluminum ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: Minimum 1-5/8 by 1-5/8 inches, but of size as required to accommodate loading.
 - 2. Material - Exterior and Unconditioned Applications: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33, with G90 coating; minimum 0.108-inch nominal thickness, but of thickness as required to accommodate loading.
 - 3. Material - Interior, Conditioned Applications: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33; 0.0966-inch minimum thickness, but of thickness as required to accommodate loading; coated with rust-inhibitive, baked-on, acrylic enamel.
- F. Wire Rope and Fittings:
 - 1. Wire Rope: Wire rope made from wire complying with ASTM A 492, Type 316.
 - 2. Wire-Rope Fittings: Connectors of types indicated, fabricated from stainless steel, and with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- G. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- H. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

2.03 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Type 316 Stainless Steel: Where stainless steel is indicated, provide Type 316 for locations at grade, or where exposure to corrosive substances such as de-icing salts is expected.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

- C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1 for use with Type 304 stainless steel, and Group 2 for use with Type 316L.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts for use with Type 304 stainless steel, and Group 2 stainless-steel bolts for use with Type 316L stainless steel, ASTM F 593, and nuts, ASTM F 594.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.04 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- H. Concrete: Comply with requirements in Division 03 "Concrete" cast-in-place concrete section for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.05 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Finish: Factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.07 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, except for elevator pit ladders.
- B. Aluminum Ladders:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ACL Industries, Inc.
 - b. Alco-Lite Industrial Products.
 - c. Halliday Products.
 - d. O'Keeffe's Inc.
 - e. Precision Ladders, LLC.
 - f. Royalite Manufacturing, Inc.
 - g. Thompson Fabricating, LLC.
 - 2. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches deep, 3/4 inch wide, and 1/8 inch thick.

3. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
4. Provide platforms as indicated fabricated from pressure-locked aluminum bar grating or extruded-aluminum plank grating, supported by extruded-aluminum framing. Limit openings in gratings to no more than 1/2 inch in least dimension.
5. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted aluminum brackets.
6. Roof Access Ladders:
 - a. Provide roof-over rail extensions, platform and steps at low parapets and flat roofs.
 - b. Provide guardrail system and toeboards on all exposed sides of ladder platform, and self-latching gate at entrance to ladderway hole. Provide manufacturer's standard hinges and self-latching mechanism for self-latching gate.
7. Finish: Standard mill finish.

2.08 STRUCTURAL-STEEL DOOR FRAMES

- A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.
 1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.
- B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- C. Finish: As specified in Article "Steel and Iron Finishes" of this Section.

2.09 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Finish: As specified in Article "Steel and Iron Finishes" of this Section.

2.10 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
 1. For bollards not indicated to be concrete filled, cap bollards with 1/4-inch-thick steel plate.
 2. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
 3. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Height and Size: Unless otherwise indicated on Drawings, provide bollard extending 4'-6" from finish floor, pavement, or grade location, with 6 inches minimum concrete coverage from pipe surfaces.
- C. Existing Concrete Slab or Pavement: Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

- D. Sleeved Bollards in New Concrete: Fabricate sleeves for bollard anchorage from steel pipe or tubing with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- E. Removable Bollards: Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.
- F. Finish: As specified in Article "Steel and Iron Finishes" of this Section.

2.11 BARRIER CABLE SYSTEMS

- A. Barrier Cable Systems: Of diameter required by performance requirements, but not less than 1/2-inch- diameter, stainless steel wire rope with turnbuckles, toggles, machine swage terminals, and other fittings and accessories for securing to structural columns and walls and for tightening barrier cable.

2.12 PIPE GUARDS

- A. Fabricate pipe guards from 3/8-inch- thick by 12-inch- wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.
- B. Finish: As specified in Article "Steel and Iron Finishes" of this Section.

2.13 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Finish: As specified in Article "Steel and Iron Finishes" of this Section.

2.14 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.15 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.16 STEEL AND IRON FINISHES

- A. Prime Paint: Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with water-based primer unless zinc coating is indicated.
- B. Zinc Coating: Provide zinc coating for all iron and steel metal fabrications to be located in outdoor or like construction, and where otherwise indicated to be zinc coated, after fabrication, as follows:
 - 1. Items to be Field Finish Painted: Zinc-rich primer.
 - 2. Items to Remain Unpainted: Galvanized.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- D. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- E. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- F. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.17 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Only proceed with installation after unsatisfactory conditions have been resolved. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
 1. Cast Aluminum: Heavy coat of bituminous paint.
 2. Extruded Aluminum: Two coats of clear lacquer.

3.04 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

3.05 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 - 1. Mound top surface to shed water.
- B. Existing Construction: Anchor bollards to existing construction with expansion anchors or anchor bolts. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
 - 1. Embed anchor bolts at least 4 inches in concrete.
- C. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete or in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- D. In Concrete Footings: Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- E. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.06 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.07 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY**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. Rooftop equipment bases and support curbs.
 - 2. Wood blocking, cants, and nailers.
 - 3. Plywood backing panels.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for sheathing.

1.03 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

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-retardant 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 D 5664.
 - 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.

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.
- B. SPRI Wind Design Standard: For nailers used in roof edge systems, provide letter certifying compliance with SPRI Wind Design Standard and specified performance requirements.

1.06 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 PERFORMANCE REQUIREMENTS**

- A. SPRI Wind Design Standard: All wood nailers and anchors used in roof edge systems shall be designed according to SPRI ED-1 and capable of resisting the following design pressure:
1. Design Pressure and Wind Loads: As indicated on Structural Drawings

2.02 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 or, if acceptable to authorities having jurisdiction, omit grade stamp and provide certificates of grade compliance issued by grading agency.
 3. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness, unless otherwise indicated.

2.03 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with ground, 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. Do not use inorganic boron (SBX) for sill plates.
 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 or, if allowed by authorities having jurisdiction, omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
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 above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.04 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 qualified 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 E 84, 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 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 accelerated weathering according to ASTM D 2898. 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 D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 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, or, if allowed by authorities having jurisdiction, omit marking and provide certificates of treatment compliance issued by inspection agency.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
 - 1. Rough carpentry items in fire rated assemblies.
 - 2. Plywood backing panels.

2.05 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
 - 1. Hem-fir (north); NLGA.
 - 2. Mixed southern pine or southern pine; SPIB.
 - 3. Spruce-pine-fir; NLGA.
 - 4. Hem-fir; WCLIB or WWPA.
 - 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 - 6. Western woods; WCLIB or WWPA.
 - 7. Northern species; NLGA.
 - 8. Eastern softwoods; NeLMA.
- C. Concealed Boards: 19 percent maximum moisture content of any of the following species and grades:
 - 1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
 - 2. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
 - 3. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
 - 4. Eastern softwoods, No. 2 Common grade; NELMA.
 - 5. Northern species, No. 2 Common grade; NLGA.
 - 6. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

- D. For blocking not used for attachment 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.
- E. 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.
- F. 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 PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.07 FASTENERS AND ANCHORS

- 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 pressure-preservative treated or fire retardant treated, and in dry service with chemical retention less than or equal to AWPAC UC4a, provide fasteners in accordance with treated wood or connector manufacturer recommendations, or in the absence of manufacturers' recommendations, as follows:
 - a. Connectors: Hot-dip zinc coated complying with ASTM A 653/A 653M, Type G185.
 - b. Fasteners: Hot-dip zinc coated complying with ASTM A 153, Class D.
 - 2. Where carpentry is pressure-preservative treated or fire retardant treated, and in dry service with chemical retention greater than or equal to AWPAC UC4a, in wet service, exposed to weather, in ground contact, exposed to ocean/water front, or in area of high relative humidity, provide fasteners in accordance with treated wood or connector manufacturer recommendations, or in the absence of manufacturers' recommendations, as follows:
 - a. Connectors: Type 316 stainless steel.
 - b. Fasteners: Hot-dip zinc coated complying with ASTM A 153, Class C.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 1002 for non-load bearing steel framing, ASTM C 954 for cold-formed metal framing, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308, as appropriate for the substrate.

2.08 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber 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 .

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Framing Standard: Comply 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-retardant-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 16 inches 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 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 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.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- 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 preservative-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. 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 WOOD BLOCKING AND NAILER INSTALLATION

- 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. Wood Blocking and Nailers at Metal Deck Under Roof Membranes: Do not install treated wood in direct contact with uncoated metal or painted metal. To avoid corrosion, provide one of the following:
1. Where treated wood blocking and nailers come in contact with metal deck, provide self-adhered polymer-modified bitumen membrane flexible flashing as a separator between treated lumber and deck.
 2. Provide untreated heartwood douglas fir wood blocking and nailers.

3.03 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.04 INSTALLATION OF PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 3. Install adjacent boards without gaps.
 4. Size: 48 by 96 inches, installed horizontally at ceiling height.

3.05 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

SECTION 061600 - SHEATHING**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. Wall sheathing.
 - 2. Parapet sheathing.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for plywood backing panels.
 - 2. Section 072726 "Fluid-Applied Membrane Air Barriers" for air and water-resistive barrier applied over wall sheathing.

1.03 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.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. 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.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; 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 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; GlasRoc.
 - b. Georgia-Pacific Building Products; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
 - d. United States Gypsum Co.; Securock.
 - 2. Type and Thickness: Type X, 5/8 inch thick.

2.03 PARAPET SHEATHING

- A. Glass-Mat Gypsum Roof Board: ASTM C 1177/1177M, glass-mat, water-resistant gypsum substrate, with surface treatment for enhancement of adhesive bonding.
 - 1. Basis-of-Design Product: Subject to compliance with requirements provide Georgia-Pacific Corporation, Dens Deck Prime; or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. Nation Gypsum Company.
 - d. United States Gypsum Co.
 - 2. Type and Thickness: Type X, 5/8 inch thick.

2.04 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or of Type 304 stainless steel.
 - 2. For parapet and wall sheathing, provide fasteners with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. 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 C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

PART 3 - EXECUTION**3.01 INSTALLATION, GENERAL**

- A. 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.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. 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.
 - 2. ICC-ES evaluation report for fastener.
- D. Coordinate parapet 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.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. 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.
- G. Replace areas of sheathing with facer delamination meeting instructions and recommendations of sheathing manufacturer, providing a sound substrate for placement of roofing flashing, waterproofing flashing, air barrier system components, and sealants.

3.02 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
 - 4. Provide control joints for wall and ceiling sheathing to allow for expansion and contraction of exterior building materials. Space at maximum 30 lineal feet, or at maximum single area of 900 square feet, for sheathing without perimeter relief.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. 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 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
- 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 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

END OF SECTION

SECTION 062023 - INTERIOR FINISH CARPENTRY**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. Interior trim.
 - 2. Shelving and clothes rods.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
 - 2. Section 099123 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.03 DEFINITIONS

- A. MDF: Medium-density fiberboard.
- B. MDO: Plywood with a medium-density overlay on the face.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors 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. Include chemical-treatment manufacturer's written instructions for finishing treated material.
 - 2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
- B. Samples for Verification:
 - 1. For each species and cut of lumber and panel products with nonfactory-applied finish, with half of exposed surface finished, 50 sq. in. for lumber and 8 by 10 inches for panels.
 - 2. For each finish system and color of lumber and panel products with factory-applied finish, 50 sq. in. for lumber and 8 by 10 inches for panels.

1.05 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For fire-retardant-treated wood, from ICC-ES.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.
- B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS**2.01 MATERIALS, GENERAL**

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI Architectural Woodwork Standards for grade as follows:
 - 1. Typical: Custom.
- B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's Board of Review. Grade lumber by an agency certified by the American Lumber Standard Committee's 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, mark grade stamp on end or back of each piece, or, if allowed by authorities having jurisdiction, omit grade stamp and provide certificates of grade compliance issued by grading agency.
- C. Softwood Plywood: DOC PS 1.
- D. Hardboard: ANSI A135.4.
- E. MDF: ANSI A208.2, Grade 130.
- F. Particleboard: ANSI A208.1, Grade M-2.
- G. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.
 - 1. Color: As selected by Architect from manufacturer's full range.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC1 for interior dry locations and UC2 for interior damp locations.
 - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
 - 2. Preservative Chemicals: Acceptable to authorities having jurisdiction, and containing no arsenic or chromium.
 - 3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
 - 4. Do not use material that is warped or does not comply with requirements for untreated material.
 - 5. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.
 - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece, or if allowed by authorities having jurisdiction, omit marking and provide certificates of treatment compliance issued by inspection agency.
 - 6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

- a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
7. Application: Where indicated.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: For applications indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and comply with testing requirements; testing will be conducted by a qualified 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 E 84, 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 beyond the centerline of the burners at any time during the test.
 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
- C. For exposed items indicated to receive a stained or natural finish, use organic resin chemical formulations that do not contain colorants, and provide materials that do not have marks from spacer sticks on exposed face.
- D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.
- E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece, or, if allowed by authorities having jurisdiction, omit marking and provide certificates of treatment compliance issued by inspection agency.
 2. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
- F. Application: Where indicated.

2.04 INTERIOR TRIM

- A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):
 1. Species and Grade: Match Architect sample.
 2. Maximum Moisture Content: 10 percent.
 3. Finger Jointing: Not allowed.
 4. Gluing for Width: Not allowed, except for lumber trim wider than 6 inches .
 5. Veneered Material: Not allowed, except for lumber trim wider than 6 inches .
 6. Face Surface: Surfaced (smooth).
 7. Matching: Selected for compatible grain and color.
- B. Hardwood Lumber Trim for Opaque Finish (Painted Finish):
 1. Species and Grade: Solid wood of any closed grain hardwood species meeting requirements of AWI Quality Standards for selection of species, grade and cut.
 2. Maximum Moisture Content: 10 percent.
 3. Finger Jointing: Not allowed.
 4. Face Surface: Surfaced (smooth).
 5. Optional Material: Primed MDF of same actual dimensions as lumber indicated may be used in lieu of lumber.
- C. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): MMPA HWM 4, N-grade wood moldings made to patterns included in MMPA's "HWM/Series Hardwood Moulding Patterns."
 1. Species: Match Architect sample.
 2. Kiln-dried softwood or MDF, with exposed surfaces veneered with species indicated, may be used in lieu of solid wood.
 3. Maximum Moisture Content: 9 percent.

4. Finger Jointing: Not allowed.
 5. Matching: Selected for compatible grain and color.
 6. Pattern: As indicated on Drawings.
- D. Moldings for Opaque Finish (Painted Finish): Made to patterns included in MMPA's "WM/Series Wood Moulding Patterns."
1. Hardwood Moldings: MMPA HWM 4, P-grade.
 - a. Species: Solid wood of any closed grain hardwood species meeting requirements of AWI Quality Standards for selection of species, grade and cut.
 - b. Maximum Moisture Content: 9 percent.
 2. Optional Material: Primed MDF.
 3. Finger Jointing: Not allowed.
 4. Pattern: As indicated on Drawings.

2.05 SHELVING AND CLOTHES RODS

- A. Closet Shelving: Made from the following material, 3/4 inch thick.
1. Melamine-faced particleboard with radiused and filled front edge.
- B. Shelf Brackets with Rod Support: BHMA A156.16, B04051; prime-painted formed steel.
- C. Shelf Brackets without Rod Support: BHMA A156.16, B04041; prime-painted formed steel.
- D. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.
- E. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.
- F. Standards for Adjustable Shelf Supports: BHMA A156.9, B04071; powder-coat-finished steel.
- G. Adjustable Shelf Supports: BHMA A156.9, B04081 or B04091; powder-coat-finished steel.
- H. Clothes Rods: 1-5/16-inch- diameter, aluminum tubes.
- I. Rod Flanges: Aluminum.

2.06 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.

2.07 FABRICATION

- A. Back out or kerf backs of the following members, except those with ends exposed in finished work:
1. Interior standing and running trim, except shoe and crown molds.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation shall indicate acceptance of conditions.

3.02 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.03 INSTALLATION, GENERAL

- A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.
- B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
 - 1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
 - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
 - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
 - 4. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.
 - 5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.04 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
 - 1. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
 - 2. Install trim after gypsum-board joint finishing operations are completed.
 - 3. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

3.05 SHELVING AND CLOTHES ROD INSTALLATION

- A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.
- B. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled. Space fasteners not more than 16 inches o.c.
 - 1. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing. Remove adhesive that is squeezed out after fastening shelf cleats in place.
- C. Install shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- D. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.
- E. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.
- F. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled. Install shelves, fully seated on cleats, brackets, and supports.

1. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.
- G. Install rod flanges for rods as indicated. Fasten to shelf cleats, framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Install rods in rod flanges.

3.06 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.07 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.08 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 064023 - INTERIOR ARCHITECTURAL MILLWORK**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. Interior architectural millwork including the following:
 - a. Architectural millwork cabinets and shelving.
 - b. Architectural millwork desks.
 - c. All other like architectural millwork built-ins, indicated as architectural millwork or architectural woodwork.
 - 2. Wood furring, blocking, shims, and hanging strips for installing architectural wood millwork unless concealed within other construction before millwork installation.
 - 3. Shop finishing of architectural wood millwork.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing millwork and concealed within other construction before millwork installation.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products, fire-retardant-treated materials, cabinet hardware and accessories, and finishing materials and processes.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show details full size.
 - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural wood millwork.
 - 4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 - 5. Samples of Initial Selection:
 - a. Shop-applied opaque finishes.
 - b. Plastic laminates.
 - c. Thermoset decorative panels.
- C. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
 - 2. Wood-grain plastic laminates, 12 by 24 inches, for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.
 - 3. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.
 - 4. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with one-half of exposed surface finished.

5. Corner pieces as follows:
 - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
6. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For the following:
 1. Composite wood and agrifiber products.
 2. Thermoset decorative panels.
 3. High-pressure decorative laminate.
 4. Adhesives.

1.06 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Fabricator of products.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver millwork until painting and similar operations that could damage woodwork have been completed in installation areas. If millwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.08 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install millwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where millwork is 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 millwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where millwork is indicated to fit to other construction, establish dimensions for areas where millwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.09 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that millwork can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087100 "Door Hardware" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS**2.01 ARCHITECTURAL MILLWORK FABRICATORS**

- A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of architectural millwork.

2.02 ARCHITECTURAL MILLWORK - GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of millwork indicated for construction, finishes, installation, and other requirements.
1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: AWI Custom.

2.03 PLASTIC-LAMINATE-FACED WOOD CABINETS, DESKS, SHELVING, AND OTHER BUILT-INS

- A. Cabinet, Door, and Drawer Front Interface Style: As indicated on Drawings.
- B. Core: Medium-density-fiberboard, 3/4 inch minimum thickness.
- C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Abet Laminati, Inc.
 - b. Formica Corporation.
 - c. Lamin-Art, Inc.
 - d. Panolam Industries International, Inc.
 - e. Wilsonart International; Div. of Premark International, Inc.
- D. Laminate Cladding for Exposed Surfaces:
1. Horizontal Surfaces: Grade HGS .
 2. Postformed Surfaces: Grade HGP.
 3. Vertical Surfaces: Grade VGS.
 4. Edges: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish .
 5. Pattern Direction: As indicated on Drawings.
- E. Materials for Semiexposed Surfaces:
1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 2. Exposed Interior Surface of Cabinets: Melamine.
 3. Drawer Sides and Backs: Solid-hardwood lumber with PVC edge banding.
 4. Drawer Bottoms: Hardwood plywood .
- F. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- G. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- H. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

- I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated on Drawings.

2.04 WOOD MATERIALS

- A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
- B. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
 - 2. Wood Moisture Content:
 - a. Typical: 5 to 10
 - b. Damp Coastal Areas of Southern US and Maritime States: 8 to 13.
 - c. Dry Southwestern United States: 4 to 9 percent.
- C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 - 2. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 - 3. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.05 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
- B. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Dark, Oxidized, Satin Bronze, Oil Rubbed: BHMA 613 for bronze base; BHMA 640 for steel base; match Architect's sample.
 - 2. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
- D. Back-Mounted Pulls: BHMA A156.9; solid metal, round rod profile, style as selected by Architect from standard range of manufacturer.
- E. Catches: Magnetic catches, BHMA A156.9, B03141.
- F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- G. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.
- H. Drawer Slides: BHMA A156.9.
 - 1. Type: Full extension.
 - 2. Static Load Capacity: As indicated below:
 - a. Box Drawer Slides: Minimum 75 lbf (Commercial Grade).
 - b. File Drawer Slides: Minimum 150 lbf (Extra Heavy Duty Grade).
 - c. Pencil Drawer Slides: Minimum 45 lbf (Light Commercial Grade).
 - d. Keyboard Slides: Minimum 75 lbf (Commercial).
 - 3. Mounting: Side mounted.
 - 4. Stops: Integral type.
 - 5. Features: Provide self-closing/stay closed type.
- I. Door and Drawer Silencers: BHMA A156.16, L03011.

- J. Sliding Door Track Assemblies: Upper and lower track of stain stainless steel, with matching shoe equipped with nylon rollers.

2.06 COUNTERTOP MATERIALS

- A. Quartz Countertops: As specified in Section 123661.19 "Quartz-Agglomerate Countertops."
- B. Plastic Laminate Countertops: As specified in Section 123623.13 "Plastic-Laminate-Clad Countertops."

2.07 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: As recommended by fabricator and meeting AWI Architectural Woowork Standards.

2.08 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets: 1/16 inch unless otherwise indicated.
- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.09 SHOP FINISHING

- A. General: Finish architectural wood millwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural wood millwork, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of millwork.
- C. Opaque Finish:
 - 1. Grade: Same as item to be finished.
 - 2. Finish: System - 5, conversion varnish.
 - 3. Color: Match Architect sample.
 - 4. Sheen: Match Architect sample; gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation shall indicate acceptance of conditions.

3.02 PREPARATION

- A. Before installation, condition millwork to average prevailing humidity conditions in installation areas.
- B. Before installing millwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.03 INSTALLATION

- A. Grade: Install millwork to comply with same grade as item to be installed.
- B. Assemble millwork and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install millwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut millwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor millwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. For shop finished items use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Maintain veneer sequence matching of cabinets with transparent finish.
 - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with one of the following:
 - a. No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.
 - b. No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
 - c. Toggle bolts through metal backing or metal framing behind wall finish.
- G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
 - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.

3.04 ADJUSTING AND CLEANING

- A. Repair damaged and defective millwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean millwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 066400 - PLASTIC PANELING**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. Glass-fiber-reinforced plastic paneling (GFRP).
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
 - 2. Section 102600 "Wall and Door Protection" for corner guards installed over plastic paneling.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type wall unit showing locations and extent. Include sections, details, and attachments to other work. Provide large scale details of forming, jointing gaskets, internal supports, anchorages, trim flashing and accessories.
- C. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.
- D. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- E. Maintenance Data: For each type panel unit to include in maintenance manuals. Include recommended methods and frequency of maintenance for maintaining optimum condition of panels under anticipated use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.04 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with panel assemblies by field measurements before fabrication and indicate measurements on Shop Drawings.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Keep plastic sheet material out of direct sunlight.
 - 3. Store plastic components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.02 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Crane Composites, Inc., Kemlite Fire-X Glasbord FM, or comparable product by one of the following:
 - a. Crane Composites, Inc.
 - b. Kal-Lite.
 - c. Marlite.
 - 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 3. Nominal Thickness: Not less than 0.09 inch.
 - 4. Surface Finish: Molded pebble texture.
 - 5. Color: As selected by Architect from manufacturer's full range.

2.03 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard two-piece, snap-on vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
 - 1. Color: Match adjacent wall panels.
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Sealant: Mildew-resistant, single-component, silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

2.04 FABRICATION

- A. Fabricate panel assembly units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates and conditions, 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. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels, and so that trimmed panels at corners are not less than 12 inches wide.
 - 1. Mark plumb lines on substrate for accurate installation.
 - 2. Locate trim accessories and/or panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.03 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with joint sealant.

3.04 CLEANING

- A. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.
- B. Clean exposed surfaces of panel assemblies immediately after completion of installation meeting written instructions and recommendations of manufacturer.
- C. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

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. Glass-fiber blanket.
 - 2. Mineral-wool blanket.
 - 3. Mineral-wool board.
 - 4. Insulation for miscellaneous voids, and around openings in the exterior wall.
- B. Related Requirements:
 - 1. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.
 - 2. Section 133419 "Metal Building Systems" for insulation included as part of metal building systems.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.05 COORDINATION

- A. Coordinate with installation of vapor retarder membrane and flashing in roof construction to ensure continuity of vapor retarder plane in exterior enclosure.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Fire-Resistance Ratings: For products required to be part of a fire-resistance rated assembly, products shall be in compliance with ASTM E119, As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.02 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Guardian Building Products, Inc.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Knauf Insulation.
 - e. Owens Corning.

2.03 MINERAL-WOOL BLANKETS

- A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. ROCKWOOL International.
 - c. Thermafiber Inc.; an Owens Corning company.

2.04 MINERAL-WOOL BOARD

- A. Mineral-Wool Board, Types IA and IB, Unfaced: ASTM C 612, Types IA and IB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Nominal density of 4 lb/cu. ft..
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. ROCKWOOL International.
 - c. Thermafiber, Inc.; an Owens Corning company.

2.05 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 - 1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 - 1. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 - 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 - 1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.

- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space between face of insulation and substrate to which anchor is attached, of depth as indicated on Drawings.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.06 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84; 2.0 lb/cu. ft. minimum density.
 - a. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
 - 1) CertainTeed Corporation.
 - 2) Dow Chemical Company.
 - 3) Huntsman Building Solutions.
 - 4) Johns Manville Corporation.
 - 5) Master Builders Solutions.
 - 6) Preferred Solutions, Inc. (PSI).
 - b. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- B. Minimal Expanding Spray Polyurethane Foam Sealant: 1 or 2 component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Dow Chemical Company; Great-Stuff PRO or comparable product by one of the following:
 - a. Dow Chemical Company.
 - b. CertainTeed Corporation.
 - c. Johns Manville Corporation.
 - d. Master Builders Solutions.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.
- C. Only proceed with installation after unsatisfactory conditions have been resolved. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.03 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.04 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.05 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.06 INSULATION SCHEDULE

- A. Insulation in Metal Framed Walls: Mineral-wool blanket or glass-fiber blanket insulation.
- B. Around Windows, Door frames, Louvers, and Other Openings in the Exterior Wall; and in Shim Space: Minimal expanding spray polyurethane foam sealant.
- C. Other Miscellaneous Areas: Spray polyurethane foam insulation.

END OF SECTION

SECTION 072600 - VAPOR RETARDERS

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. Polyolefin vapor retarders.
- B. Related Requirements:
 - 1. Section 072100 "Thermal Insulation" for vapor retarders integral with insulation products.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.01 POLYOLEFIN VAPOR RETARDERS

- A. Polyolefin Membrane: ASTM E1745, Class A; high density polyolefin extruded geomembrane sheet Class I vapor retarder, 0.015 inch minimum thickness.
 - 1. Products: Subject to compliance with requirements, provide one of following:
 - a. Fortifiber Building Systems Group, Moistop Ultra 15, and associated tape and adhesive.
 - b. Reef Industries, Inc., Griffolyn 15 Mil Green, and Griffolyn Tape and Adhesive.
 - c. Stego Industries, LLC, 15 Mil Stego Wrap, and Stego Tape and Adhesive.
 - 2. Water Vapor Permeance: 0.01 perms maximum after mandatory conditioning tests per ASTM E1745, Section 7.1, when evaluated meeting requirements of ASTM E96, Procedure B.
 - 3. Wet Tensile Strength: 70 pounds per linear inch, average of machine and traverse directions, minimum, when evaluated meeting requirements of ASTM D882.
 - 4. Puncture Resistance: 2200 grams minimum when evaluated meeting requirements of ASTM D1709.

2.02 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.
- D. Sealant: Single-component non-sag urethane sealant as specified in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify substrate surfaces are flat, and free of fins, irregularities, materials, substances or debris that may be capable of puncturing vapor retarders.

- B. Only proceed with installation after unsatisfactory conditions have been resolved. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.03 INSTALLATION, GENERAL

- A. Joint Sealing: Seal joints between vapor retarder units and seal vapor retarder to penetrations, and adjoining surfaces and intersecting components at extremities of coverage by lapping 6 inches minimum, and bonding overlaps with joint tape or adhesive. Joints shall be continuously sealed to assure complete adhesion and vapor tightness.
- B. Repair:
 - 1. Any penetration of installed vapor retarder shall be repaired and made vapor tight before concealment by other work.
 - 2. Use repair tape, or strips of vapor retarder material with repair tape or adhesive to seal punctures, tears and penetrations through vapor retarder.

3.04 INSTALLATION OF VAPOR RETARDERS UNDER CONCRETE SLABS-ON-GRADE

- A. Provide vapor retarder under entire area of concrete slabs-on-grade.
- B. Extend coverage of vapor retarder to extremities of such areas. Extend vapor retarder a distance of 12 inches minimum onto adjoining surfaces, but do not extend onto surfaces to be exposed to view in completed work or to be coated with another material.
- C. Place vapor retarder units in rows with edges overlapped 12 inches minimum onto adjacent units. Stagger ends 2 feet minimum from ends of units in adjacent rows.
- D. Where vapor retarder is placed on a sloped surface, shingle vapor retarder laps orientated for drainage across laps, not against exposed edges of laps.
- E. Seal joints in vapor retarders by lapping and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions.
- F. Seal joints caused by pipes, conduits, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- G. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.05 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.
- B. Provide temporary protection for insulation materials that may subject to damage and abuse.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM**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. Formed roof-drainage sheet metal fabrications.
 - 2. Formed low-slope roof sheet metal fabrications.
 - 3. Formed wall sheet metal fabrications.
 - 4. Formed equipment support flashing.
 - 5. Formed overhead-piping safety pans.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
 - 2. Roofing sections for materials and installation of sheet metal flashing and trim integral with roofing.
 - 3. Exterior metal panel wall system sections for sheet metal flashing and trim integral with metal wall panels.
 - 4. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.03 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary conditions, and procedures for coping with inclement weather.
 - 3. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
 - 4. Review warranty provisions and requirements of roofing work related to sheet metal flashing and trim.
 - 5. Review requirements for insurance and certificates if applicable.
 - 6. Review sheet metal flashing observation and repair procedures after flashing installation.

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 manufactured product and accessory.
- B. Shop Drawings: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
 - 3. Include identification of material, thickness, weight, and finish for each item and location in Project.

4. Include details for forming, including profiles, shapes, seams, and dimensions.
 5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 6. Include details of termination points and assemblies.
 7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 8. Include details of roof-penetration flashing.
 9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
 10. Include details of special conditions.
 11. Include details of connections to adjoining work.
- C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.
- D. Samples for Verification: For each type of exposed finish.
1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
 3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Sample Warranty: For special warranty, including project specific requirements and warranty period.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
1. For copings and roof edge flashings that are SPRI ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows 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 D 2244.

- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- c. Cracking, checking, peeling, or failure of 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. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Copings and Roof Edge Flashings: Manufacture and install copings and roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure.
 - 2. Nailers and Anchors: All wood nailers and anchors used in roof edge systems shall be designed according to SPRI ED-1 and capable of resisting the following design pressure.
 - 3. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 - a. For dark colored members in a horizontal position, allow for material surface temperature change of 230 deg F.
- E. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.
- F. Metal Flatness: Flat metal components shall have exposed surfaces of such flatness that when measured, maximum slope of surface at any point, measured from nominal plane of surface, shall not exceed 1.25 percent.

2.02 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B 209 , alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.
 - 1. As-Milled Finish: Mill.
 - 2. Exposed Coil-Coated Finish: One of following to match adjacent materials as acceptable to Architect:
 - a. High-Performance Organic Finish - Two-Coat Fluoropolymer: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. High-Performance Organic Finish - Three- Coat Fluoropolymer: Three -coat fluoropolymer finish, including metallics, complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

- c. Color: Custom, to match Architect's sample.
- 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil .
- C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish - Exposed: 4 (polished directional satin).
 - 2. Finish - Concealed: 2D (dull, cold rolled).
- D. Metallic-Coated Steel Sheet: Provide aluminum-zinc alloy-coated steel sheet according to ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 ; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finish: One of following to match adjacent materials as acceptable to Architect:
 - a. High-Performance Organic Finish - Two-Coat Fluoropolymer: Two-coat fluoropolymer finish complying with AAMA 621 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - b. High-Performance Organic Finish - Three- Coat Fluoropolymer: Three -coat fluoropolymer finish, including metallics, complying with AAMA 621 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - c. Color: Custom, to match Architect's sample.
 - 3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil .

2.03 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle Coatings & Waterproofing Inc; CCW WIP 300HT.
 - b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HTUltra.
 - c. Henry Company; Blueskin PE200 HT.
 - d. Kirsch Building Products, LLC; Sharkskin Ultra SA.
 - e. Metal-Fab Manufacturing, LLC; MetShield.
 - f. Owens Corning; WeatherLock Metal High Temperature Underlayment.
 - g. Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
 - 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
 - 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F or lower.

2.04 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
 - 4. Fasteners for Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Solder:
 - 1. For Stainless Steel: ASTM B 32, 80 percent tin and 20 percent lead where exposed and 60 percent tin and 40 percent lead where covered, with acid flux of type recommended by stainless-steel sheet manufacturer.
 - 2. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.
- D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- H. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.05 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams - Soldered Metals: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Seams - Painted or Coated Metals: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- I. Seams for Aluminum - Uncoated Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
- J. Do not use graphite pencils to mark metal surfaces.

2.06 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness, unless greater thickness is indicated on Drawings. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
1. Gutter Profile: As indicated on Drawings.
 2. Expansion Joints: Butt type with cover plate.
 3. Accessories: .
 4. Finish: High performance organic (PVDF) finish.
 5. Gutters with Girth up to 15 Inches : Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.
 6. Gutters with Girth 16 to 20 Inches : Fabricate from the following materials:
 - a. Aluminum: 0.040 inch thick.
 7. Gutters with Girth 21 to 25 Inches : Fabricate from the following materials:
 - a. Aluminum: 0.050 inch thick.
 8. Gutters with Girth 26 to 30 Inches : Fabricate from the following materials:
 - a. Aluminum: 0.063 inch thick.
- B. Downspouts: Fabricate downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
1. Hangar Style: As indicated on Drawings.
 2. Finish: High performance organic (PVDF) finish.
 3. Fabricate from the following materials:
 - a. Aluminum: 0.024 inch thick.
- C. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
1. Finish: High performance organic (PVDF) finish.
 2. Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.

- D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, and built-in overflows.
 - 1. Finish: High performance organic (PVDF) finish.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.
- E. Splash Pans: Fabricate to dimensions and shape required.
 - 1. Finish: High performance organic (PVDF) finish.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.040 inch thick.

2.07 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long sections. Furnish with 6-inch- wide, joint cover plates. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Butted with expansion space and 6-inch- wide, exposed cover plate.
 - 2. Fabricate with scuppers spaced maximum 10 feet apart, to dimensions required with 4-inch- wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 - 3. Finish: High performance organic (PVDF) finish.
 - 4. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch thick.
- B. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12-foot- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, lap seam, and seal watertight. Shop fabricate interior and exterior corners.
 - 1. Coping Profile: according to SMACNA's "Architectural Sheet Metal Manual."
 - 2. Coping Profile: As indicated on Drawings.
 - 3. Joint Style: Butted with expansion space and 6-inch- wide, exposed cover plate.
 - 4. Finish: High performance organic (PVDF) finish.
 - 5. Fabricate from the Following Materials:
 - a. Aluminum: 0.050 inch thick.
- C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch thick.
- D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
- E. Flashing Receivers: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
- F. Roof-Penetration Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.019 inch thick.
- G. Roof-Drain Flashing: Fabricate from the following materials:
 - 1. Stainless Steel: 0.016 inch thick.

2.08 WALL SHEET METAL FABRICATIONS

- A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams.
 - 1. Finish: High performance organic (PVDF) finish.

2. Fabricate from the following materials:
 - a. Aluminum: 0.032 inch thick.

2.09 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
 1. Stainless Steel: 0.019 inch thick.
- B. Overhead-Piping Safety Pans: Fabricate from the following materials:
 1. Stainless Steel: 0.025 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 1. Verify compliance with requirements for installation tolerances of substrates.
 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller. Cover underlayment within 14 days.

3.03 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 5. Torch cutting of sheet metal flashing and trim is not permitted.
 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws, but at minimum not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches ; however, reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel and aluminum sheet.
 2. Do not use torches for soldering.
 3. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 4. Stainless-Steel Soldering: Tin edges of uncoated sheets, using solder for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
- H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.04 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with riveted and soldered joints or joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
1. Fasten gutter spacers to front and back of gutter.
 2. Anchor and loosely lock back edge of gutter to continuous cleat, eave or apron flashing.
 3. Anchor gutter with gutter brackets spaced not more than 36 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
 4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

5. Install continuous gutter screens on gutters with noncorrosive fasteners, removable for cleaning gutters.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
 1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c.
 2. Provide elbows at base of downspout to direct water away from building.
 3. Connect downspouts to underground drainage system.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in elastomeric sealant compatible with the substrate.
- E. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 1. Anchor scupper closure trim flange to exterior wall and solder or seal with elastomeric sealant to scupper.
 2. Loosely lock front edge of scupper with conductor head.
 3. Solder or seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- F. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper or gutter discharge.
- G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

3.05 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.
 1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
 2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric or butyl sealant, as required for compatibility with roofing membrane, and clamp flashing to pipes that penetrate roof.

3.06 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of through-wall flashing is specified in .

- C. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend minimum 4 inches beyond wall openings. Up turn interior flashing leg and fully seal end dams.

3.07 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans: Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

3.08 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.09 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Roof curbs.
 - 2. Equipment supports.
 - 3. Pipe and duct supports.
 - 4. Pipe portals.
- B. Related Sections:
 - 1. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

1.03 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of roof accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For roof accessories.
 - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.

1.06 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Wind-Restraint Performance: As indicated on Drawings.

2.02 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom for installation directly on roof deck, not on insulation.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. AES Industries, Inc.
 - b. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - c. Pate Company (The).
 - d. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
 - e. Thybar Corporation.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc-coated (galvanized) steel sheet, minimum 0.052 inch thick.
 - 1. Finish: Manufacturer standard.
- D. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 - 3. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
 - 4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange.
 - 5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
 - 6. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
 - 7. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 8. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.
 - 9. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb, of size and spacing where required to meet wind uplift requirements.
 - 10. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 - 11. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.03 EQUIPMENT SUPPORTS

- A. Equipment Supports: Internally reinforced perimeter metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, and integrally formed structure-mounting flange at bottom.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. AES Industries, Inc.
 - b. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - c. Pate Company (The).
 - d. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
 - e. Thybar Corporation.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc-coated (galvanized) steel sheet, minimum 0.052 inch thick.
 - 1. Finish: Manufacturer standard.
- D. Construction:
 - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
 - 3. Nailer: Factory-installed continuous wood nailers on top flange of equipment supports, continuous around support perimeter.
 - 4. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing where required to meet wind uplift requirements.
 - 5. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 - 6. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
 - 7. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 - 8. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
 - 9. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.04 PIPE AND DUCT SUPPORTS

- A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2-inch- diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.
- B. Fixed-Height Roller-Bearing Pipe Supports: Polycarbonate pipe stand with polycarbonate or stainless-steel roller carrying assembly accommodating up to 7-inch-diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.
- C. Adjustable-Height Structure-Mounted Pipe Supports: Extruded-aluminum tube, filled with urethane insulation; 2 inches in diameter; accommodating up to 7-inch- diameter pipe or conduit, with provision for pipe retainer; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, stainless-steel roller and retainer, and extruded-aluminum carrier assemblies; as required for quantity of pipe runs and sizes.

- D. Curb-Mounted Pipe Supports: Galvanized steel support with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom; with adjustable-height roller-bearing pipe support accommodating up to 20-inch- diameter pipe or conduit and with provision for pipe retainer; as required for quantity of pipe runs and sizes.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Miro Industries.
 - b. Pate Company (The).
 - c. PHP Systems/Design.
 - d. Thaler Metal Industries Ltd.
- E. Duct Supports: Extruded-aluminum, urethane-insulated supports, 2 inches in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Thaler Metal Industries Ltd.
 - 2. Finish: Manufacturer's standard.

2.05 PIPE PORTALS

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Roof Penetration Housings, LLC.
 - b. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
- B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Roof Penetration Housings, LLC.
 - b. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

2.06 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation, and mill phosphatized for field painting where indicated.
 - 1. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

2.07 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPAC2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Underlayment:

1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
 2. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 3. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
 4. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 5. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- G. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.08 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.

- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
 - 1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- F. Seal joints with elastomeric butyl sealant as required by roof accessory manufacturer.

3.03 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 078400 - FIRESTOPPING**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: Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, including but not limited to the following:
 - 1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
 - 2. Safing slot gaps between edge of floor slabs and curtain walls.
 - 3. Openings between structurally separate sections of wall or floors.
 - 4. Gaps between the top of walls and ceilings or roof assemblies.
 - 5. Expansion joints in walls and floors.
 - 6. Openings and penetrations in fire-rated partitions or walls containing fire doors.
 - 7. Openings around structural members which penetrate floors or walls.
- B. Related Requirements:
 - 1. Section 017000 "Execution and Closeout Requirements" for cutting and patching.
 - 2. Section 078100 "Applied Fireproofing."

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at project site to review conditions associated with performing work. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include Quality Control Service, representative of Owner's insurance company, if applicable, manufacturer's representative, installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant.
 - 1. Work schedule.
 - 2. Required quality assurance and quality control procedures, testing and inspections.
 - 3. Code considerations and insurance requirements.
 - 4. Review products, design ratings, movement conditions, and other performance requirements.
 - 5. Review preparation and installation procedures, and coordinating and scheduling required with related work.
 - 6. Substrate conditions.
 - 7. Temporary conditions, and procedures for coping with inclement weather.
 - 8. Protection of complete work.

1.04 ACTION SUBMITTALS

- A. Product Data: Provide product data on each type of product, including product characteristics, performance ratings, and limitations.
- B. Schedule of Firestopping: For each firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency
 - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular firestopping system, submit illustration, with modifications marked, approved by firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each firestopping system, for tests performed by a qualified testing agency.
- C. Compatibility Test Reports: From firestopping manufacturer indicating the following:
 - 1. Substrate materials have been tested for compatibility and adhesion with firestopping materials.
 - 2. Interpretation of test results and written recommendations.

1.06 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.
- B. Schedule of Installed Firestopping: Supply documentation for each assembly addressed. Documentation is to identify each type penetration and joint location in the Work, tested system or engineering judgment number, location of systems, and materials installed. Copies of these documents are to be provided at the completion of the project.

1.07 QUALITY ASSURANCE

- A. Product Qualifications: Obtain firestopping systems, for each kind of penetration, joint and construction condition indicated, through one source from a single manufacturer.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum 5 years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and the following. Provide proof of qualifications.
 - 1. Approved by UL or Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors, or meeting any two of the following requirements:
 - 2. With minimum 5 years documented experience installing work of this type.
 - 3. Able to show at least 5 satisfactorily completed projects of comparable size and type. Include the project name, type, address, and date of completion.
- D. Manufacturer Representative: Require site attendance of manufacturer's qualified direct technical representative during installation of the work, and during inspections and testing specified in Article - Field Quality Control.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Products and materials shall be delivered to project site in original, unopened containers and packages with readable manufacturer labels identifying product and manufacturer, date of manufacture, lot number, shelf life, if applicable, qualified testing agency classification marking applicable to project, curing time, and mixing instructions.
- B. Store and handle materials in a manner that prevents damage and deterioration due to moisture exposure, temperature changes, contaminants and other causes.

1.09 PROJECT CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure systems are installed meeting specified requirements.
- B. Coordinate size of sleeves, openings, cored holes or other like cut openings.
- C. Notify inspecting agency responsible for testing and inspections 7 days minimum prior to commencement of firestopping system installation.

PART 2 - PRODUCTS**2.01 FIRESTOPPING - GENERAL REQUIREMENTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Fire Protection Products.
 - 2. A/D Fire Protection Systems Inc.
 - 3. Hilti, Inc.
 - 4. RectorSeal.
 - 5. Specified Technologies, Inc.
 - 6. Tremco, Inc.
- B. Firestopping: Any material meeting requirements. See drawings for required ratings and firestopping schedule at the end of this section.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.
- D. Firestopping components shall be free of carcinogens and compatible with each other, substrates forming openings and items penetrating firestopping under conditions of required service, under conditions of service and application, as demonstrated by firestopping system manufacturer based on testing and field experience.
- E. Firestopping shall be flexible and pliable after curing to allow for normal, dynamic and seismic movements of building structure and substrate, expansion and contraction of building assemblies and movement of penetrating objects without cracking, becoming displaced or allowing cracks, voids or through openings to occur.
- F. Compatibility: Provide firestopping materials that are compatible with one another and with substrates under conditions of service and application, as demonstrated by firestopping manufacturer, based on testing.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.
- B. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
- C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor (Head-of-Wall and Bottom-of-Wall) Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 or UL 1479 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 - 1. T-Rating (Temperature Rise): When penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
 - 2. W-Rating (Watertightness): Class 1 rating in accordance with water leakage test per UL 1479 for floor and horizontal assemblies only.
- E. Penetrations in Smoke Barriers: Use any system that has been tested according to UL 1479 to have air leakage L Rating not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30 inch water at both ambient and elevated temperatures.
- F. Joints in Smoke Barriers: Use any system that has been tested according to UL 2079 to have air leakage L Rating not exceeding 5.0 cfm/linear. ft. of joint at 0.30 inch water at both ambient and elevated temperatures.
- G. Mold Resistance: Provide penetration firestoppping with mold and mildew resistance rating of 0 as determined by ASTM G21.

- H. Firestopping materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.03 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
1. Fire Ratings:
 - a. Provide firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
 - b. Provide firestop system with an assembly rating as determined by UL 2079 or ASTM E1966 which is equal to the time rating of construction joint assembly.
 2. UL Classification: Products shall be UL Classified Product with UL Classification Marking.
- B. Firestopping Materials:
1. Latex Sealants and Sprays: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
 2. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
 3. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
 4. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
 5. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
 6. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
 7. Foams: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
 8. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants, pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
 9. Acrylic Sealants and Sprays: Single Component, acrylic based, paintable sealant or spray.
 10. Blocks, Boards and Plugs: Non curing, re-penetrable, re-usable materials for use with noncombustible and combustible penetrants.
- C. Pre-Formed and Factory Assembled Devices:
1. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer plastic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
 2. Firestop Collars: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
 3. Drop-In Place Firestop Devices: Post install factory assembled devices for use in concrete floors with noncombustible and combustible penetrants. Consisting of a metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete and a neoprene gasket.
 4. Fire-Rated Pathways: Re-penetrable factory assembled devices for use in gypsum, masonry or concrete walls or concrete floors with noncombustible and combustible penetrants. Device consists of a metallic sleeve lined with multiple intumescent strips and flexible smoke seal membrane that can be twisted or tightened shut to ensure maximum air tightness, and twisted open to allow for future re-penetration of cables.

5. Firestop Top Track Seal: One-piece, pre-formed, polyurethane foam based, firestop seal for use with standard head-joint top tracks and bottom-joint tracks, and slip-type head joints in fire-rated construction at top or bottom of partition to maintain continuity of the fire-resistance-rated assembly indicated. Provide in width and configuration required to accommodate depth and installation of studs and designed to saddle-over the top track or under the bottom-track.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Hilti, Inc.; Model CFS-TTS Firestop Top Track Seal.
 - b. Use only firestop top track seal product that has been UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, space requirements and fire-rating required for each application.
 - c. Performance Requirements:
 - 1) Movement: +/- 50 percent.
 - 2) Surface Burning Characteristics (U.L. 723) ASTM E84: Flame Spread: 10; Smoke Development: 20.
- D. Accessories: Provide components for each firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated. Accessories include, but are not limited to, the following items:
 1. Permanent forming/damming/backing materials, including the following:
 - a. Mineral wool fiber insulation.
 - b. Pre-formed mineral wool plugs or strips.
 - c. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - d. Fire-rated form board.
 - e. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.
 4. Collars.
 5. Steel sleeves.
- E. Mixing: For those products requiring mixing before application, comply with firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.
- B. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Surface Cleaning: Before installing firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of firestopping materials.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping materials. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.03 INSTALLATION

- A. General: Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Forming and Backing Materials: Install forming, damming and backing materials and other accessories of types as required to support fill materials during application to prevent material leakage and produce shapes and depths required to achieve required fire ratings. Remove combustible not indicated as permanent components of assembly, after filling materials have fully cured and dried.
- C. Filling Materials:
 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 2. Materials shall be applied to fully contact and adhere to opening substrates and penetrating items.
 3. Fill materials to remain exposed in the complete work shall be finished with smooth, uniform surfaces flush with adjacent surfaces.
- D. Do not cover installed firestopping until inspected by field quality control service and authority having jurisdiction.

3.04 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- B. Firestopping Systems: Install labeling as follows, and if required by Owner, code or 3rd party inspection agencies:
 1. Identify firestopping systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted
 2. Include following information on labels:
 - a. Words: "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage" or "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage", as applicable.
 - b. Contractor's name, and phone number.
 - c. Product name.
 - d. Firestopping system designation of applicable testing and inspecting agency.
 - e. Date of installation.
 - f. Firestopping manufacturer's name.

3.05 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174 for penetration firestopping and ASTM E 2393 for fire-resistant joint systems, and codes and standards of authorities having jurisdiction.
- B. Where deficiencies are found or firestopping system is damaged or removed because of testing, repair or replace firestopping system to comply with requirements.
- C. Proceed with enclosing firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by firestopping system manufacturers and that do not damage materials in which openings occur.

3.07 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.
- B. Provide final protection and maintain conditions during and after installation that ensure that firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping systems immediately and install new materials to produce systems complying with specified requirements.

3.08 FIRESTOPPING SCHEDULE

- A. General: Provide firestopping system of respective type for firestopping location indicated in this Schedule. In addition, provide firestopping system of appropriate type at locations not specifically scheduled.

* NOTE: SYSTEMS PROVIDED BELOW ARE FOR GUIDANCE ONLY. CONTRACTOR TO SUBMIT ACTUAL SYSTEMS TO BE INSTALLED ON PROJECT MEETING REQUIREMENTS OF ARTICLE "SUBMITTALS" OF THIS SECTION.

PENETRATION FIRESTOPPING UL CLASSIFICATION SYSTEM

Firestopping Systems	Construction Penetrated	UL Classification System Type of Construction	System Identification
No Penetrating Items	F, W, C	A, B, J, K, L	0001-0999
Metallic Pipes, Conduit or Tubing	F, W, C	A, B, J, K, L	1001-1999
Nonmetallic Pipe, Conduit or Tubing	F, W, C	A, B, J, K, L	2001-2999
Electrical Tables	F, W, C	A, B, J, K, L	3001-3999
Cable Trays with Electrical Cables	F, W, C	A, B, J, K, L	4001-4999
Insulated Pipes	F, W, C	A, B, J, K, L	5001-5999
Electrical Bus Duct Penetrations	F, W, C	A, B, J, K, L	6001-6999
Mechanical Ductwork Penetrations	F, W, C	A, B, J, K, L	7001-7999
Multiple Penetrations Through Common Openings	F, W, C	A, B, J, K, L	8000-8999

Construction Penetration

F: Floor penetration
W: Wall penetration
C: Either floor or wall penetration

Type of Construction

A: Concrete floors equal to less than 5 inches thick
B: Concrete floors greater than 5 inches thick
J: Concrete or masonry walls equal to or less than 8 inches thick
K: Concrete or masonry walls greater than 8 inches thick
L: Framed walls

FIRE-RESISTANT JOINT SYSTEMS - UL CLASSIFICATION SYSTEM

System Types	Construction	Movement Capability	Joint Width
Floor to Floor	FF	S, D	0000-3999
Wall to Wall	WW	S, D	0000-3999
Floor to Wall	FW	S, D	0000-3999
Head of Wall	HW	S, D	0000-3999

Movement Capability

S: Static
D: Dynamic

Joint Width

0000-0999: Less than or equal to 2 inches
1000-1999: Greater than 2 inches and less than or equal to 6 inches
2000-2999: Greater than 6 inches and less than or equal to 12 inches
3000-3999: Greater than 12 inches and less than 24 inches

END OF SECTION

SECTION 079200 - JOINT SEALANTS**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. Nonstaining silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Mildew-resistant joint sealants.
 - 4. Butyl joint sealants.
 - 5. Latex joint sealants.
- B. Related Requirements:
 - 1. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
 - 2. Section 078400 "Firestopping" for firestopping sealants.
 - 3. Section 088000 "Glazing" for glazing sealants and accessories.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site prior to starting work at project site to review conditions associated with performing work. Meeting shall include review of construction conditions, substrate conditions, environmental requirements, special details, testing required, criteria for field testing required to achieve manufacturer's warranty, and coordination required. Participants shall include Owner, Architect, Contractor, representative of sealant manufacturer, installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant.

1.04 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency, or a qualified testing agency.
- B. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

- C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- D. Field-Adhesion-Test Reports: For each sealant application tested, including all failures.
- E. Sample Warranties: For special warranties, including project specific requirements and warranty period.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Manufacturer Technical Representative: Furnish services of trained technical representative of joint sealant manufacturer to advise on installation of work. Services of representative at a minimum, shall include attendance of preinstallation meetings, examination of substrates prior to installation, witnessing field testing, and inspection of final installation. Representative shall prepare written reports and submit to Contractor, with copy to Owner and Architect.
- C. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of actual materials for the Work that will contact or affect joint sealants.
 - 1. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - a. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.
 - b. For materials not previously tested use ASTM C 794 as specified above.
 - 2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
 - 3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with stone or masonry substrates.
 - 4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
 - 5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
- B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each kind of sealant and joint substrate.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

- 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.08 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 2. When joint substrates are wet.
 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.09 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 1. Warranty Period: Five years from date of Substantial Completion, unless otherwise indicated below:
 - a. Material Warranty for Silicone Sealants: 20 years.
 - b. Weatherseal Warranty for Exterior Silicone Sealants: 20 years.
 - c. Non-Staining Warranty for Silicone Sealants: 20 years.
 - d. Hybrid Polyurethane Sealants: 10 years.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 2. Disintegration of joint substrates from causes exceeding design specifications.
 3. Mechanical damage caused by individuals, tools, or other outside agents.
 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

- B. Silicone, Nonstaining, Low Modulus: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Construction Sealants; Momentive Performance Materials Inc; SilPruf LM.
 - c. Tremco Incorporated; Spectrem 1.
- C. Silicone, Nonstaining, Medium Modulus: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 756 SMS .
 - b. GE Construction Sealants; Momentive Performance Materials Inc; SCS9000 SilPruf NB.
 - c. Tremco Incorporated; Spectrem 3.

2.03 URETHANE JOINT SEALANTS

- A. Urethane, Single-Component, Nonsag: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant.
 - b. Master Builders Solutions; MasterSeal NP 1.
 - c. Sika Corporation; Sikaflex - 1a.
 - d. Tremco Incorporated; Dymonic 100.
- B. Urethane, Single-Component, Pourable (Self-Leveling): Single-component, pourable (self-leveling), plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; NR-201.
 - b. Master Builders Solutions; MasterSeal SL 1.
 - c. Sika Corporation; Sikaflex - 1CSL.
 - d. Tremco; Vulkem 45.
- C. Urethane, Multicomponent, Nonsag: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; DynaTrol II General Purpose Two Part Polyurethane Sealant.
 - b. Master Builders Solutions; MasterSeal NP-2.
 - c. Sika Corporation; Sikaflex - 2c NS.
 - d. Tremco Global Sealants; Dymeric 240.
- D. Urethane, Multicomponent, Pourable (Self-Leveling): Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; DynaTrol 11-SG.
 - b. Master Builders Solutions; MasterSeal SL 2.
 - c. Sika Corporation; Sikaflex - 2c SL.
 - d. Tremco Global Sealants; THC-900 or THUC-901.

2.04 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 786-M White.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
 - c. Tremco Incorporated; Tremsil 200.

2.05 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc.; Chem-Calk 300.
 - b. Pecora Corporation; BC-158.
 - c. Tremco; Tremco Butyl Sealant.

2.06 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Master Builders Solutions; Sonolac.
 - b. Pecora Corporation; AC-20.
 - c. Tremco Incorporated; Tremflex 834.

2.07 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; non-outgassing; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Master Builders Solutions.
 - b. Construction Foam Products, a division of Nomaco, Inc.
- B. Cylindrical Sealant Backings: ASTM C 1330, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance as recommended in writing by manufacturer for joint application indicated. Backing type shall be as follows, or as approved in writing by joint-sealant manufacturer for joint application indicated:
 - 1. Typical: Type B (bicellular material with a surface skin), non-out gassing.
 - 2. Two-Stage Sealants in Precast Concrete, and like Applications with Confined Sealant Joints Requiring Curing from The Inside: Type O (open-cell material).
 - 3. Single-Component Sealants: Type O (open-cell material).
 - a. Exception: Do not use Type O (open-cell material) in horizontal surface applications.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.08 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer based on results of field-testing. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.04 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Manufacturer's Technical Representative: Require site attendance of qualified technical representative of joint sealant manufacturer during testing and inspections. Representative shall prepare written reports and submit to Contractor, with copy to Owner and Architect.
 - 2. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. For each area to be inspected, perform procedure every 100 linear ft in the first 1,000 linear ft of joint.
 - b. If not test failure is observed in the first 1,000 ft of joint, perform procedure every 1,000 linear ft thereafter or approximately once per floor per elevation.
 - 3. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 4. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - 5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - 6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 JOINT-SEALANT SCHEDULE

- A. General: Where Contract Documents do not indicate a specific sealant, provide sealant of respective type for space and substrate indicated in this Schedule. In addition, provide sealant of appropriate type at other locations as required.
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints in brick pavers.
 - b. Isolation and contraction joints in cast-in-place concrete slabs.
 - c. Joints between plant-precast architectural concrete paving units.
 - d. Joints in stone paving units, including steps.
 - e. Tile control and expansion joints.
 - f. Joints between different materials listed above.
 - g. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Urethane, multicomponent, pourable (self-leveling).
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces, as follows:
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints between different materials listed above.
 - e. Control and expansion joints in ceilings and other overhead surfaces.
 - f. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, non-staining, medium modulus.
- D. Joint-Sealant Application: Exterior joints in Stone Cladding and Veneer: Silicone, non-staining, medium modulus; unless laboratory testing shows adhesion or staining issues, then use urethane, multi-component, non-sag.
- E. Joint-Sealant Applications: Exterior joints in exterior metal work.
 - 1. Joint Locations:
 - a. Joints between metal panels.
 - b. Joints between metal panels and adjacent work.
 - c. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone, non-staining, medium modulus.
- F. Joint-Sealant Applications: Exterior joints in fenestration systems, and between fenestration and adjacent work.
 - 1. Joint Locations:
 - a. Curtain wall, window wall and entrance and storefront systems.
 - b. Perimeter joints between frames of doors, windows and louvers; and adjacent work.
 - c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, non-staining, medium modulus.
- G. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in stone flooring.
 - c. Control and expansion joints in brick flooring.
 - d. Control and expansion joints in tile flooring.
 - e. Other joints as indicated on Drawings.
 2. Joint Sealant: Urethane, multicomponent, pourable (self-leveling).
- H. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of interior unit masonry, concrete walls and partitions.
 - d. Joints on underside of plant-precast structural concrete beams and planks.
 - e. Aesthetic perimeter joints (not weather/air seals) between interior wall surfaces and frames of interior doors, windows, and elevator entrances. For interior weather/air seals use silicone, non-staining, medium modulus.
 - f. Other joints as indicated on Drawings.
 2. Joint Sealant: Urethane, single-component, nonsag; silicone, nonstaining, low modulus; or silicone, non-staining, medium modulus.
- I. Joint-Sealant Application: Interior joints in exposed locations of gypsum board assemblies not subject to significant movement, where acoustical sealant is not required.
 1. Joint Sealant: Acrylic latex.
 2. Fire-Rated Construction: For fire-rated construction, provide firestopping sealant meeting requirements of Section 078400 "Firestopping."
- J. Joint-Sealant Application: Interior joints in acoustically rated construction.
 1. Joint Sealant: Acoustic sealant as specified in Section 079219 "Acoustic Joint Sealants."
 2. Fire-Rated Construction: For fire-rated construction, provide firestopping sealant meeting requirements of Section 078400 "Firestopping."
- K. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 1. Joint Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Joints in other wet areas such as:
 - 1) Janitorial closets.
 - d. Other joints as indicated on Drawings.
 2. Joint Sealant: Silicone, mildew resistant, acid curing.
- L. Joint-Sealant Application: Concealed mastics.
 1. Joint Locations:
 - a. Thresholds.
 - b. Sill plates.
 - c. Concealed sheet metal sealant applications.
 - d. Other joints as indicated on Drawings.
 2. Joint Sealant: Butyl-rubber based.

END OF SECTION

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

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. Acoustical joint sealants.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.03 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of acoustical joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- B. Compatibility Test Reports: From acoustic sealant manufacturer indicating the following:
 - 1. Substrate materials have been tested for compatibility and adhesion with acoustic sealant and backing materials.
 - 2. Interpretation of test results and written recommendations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Compatibility: Provide acoustic sealant and backing materials that are compatible with one another and with substrates under conditions of service and application, as demonstrated by acoustic sealant manufacturer, based on testing.

2.02 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; RCS20 Acoustical.
 - b. Hilti, Inc.; CP506 Smoke and Acoustic Sealant.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Tremco, Incorporated; Tremco Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; BA-98.
 - b. Serious Energy Inc.; Quiet Seal 350.
- C. Acoustic Sealant for Fire-Rated Construction: Manufacturer's standard nonsag, nonstaining latex acoustical firestopping sealant complying with ASTM C 834 and Section 078400 "Firestopping."
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; AC-20 FTR.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.

2.03 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. STC-Rated and Fire-Rated Assemblies: Meet requirements of this Section and Section 078400 "Firestopping."

- D. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.04 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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. Hollow-metal work.
- B. Related Requirements:
 - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.03 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.04 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.05 PREINSTALLATION MEETINGS

- A. Pre-Submittal Conference: When doors and frames are to receive electrified and access control hardware, conduct conference in compliance with requirements in Division 01 with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.06 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.
 - 7. Details of accessories.
 - 8. Details of moldings, removable stops, and glazing.
 - 9. Details of conduit and preparations for power, signal, and control systems.
- C. Samples for Verification:
 - 1. Samples are only required by request of the architect and for manufactures that are not current members of the Steel Door Institute.
- D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.07 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Product evaluations: Provide copy of current Product Evaluation acceptable to authorities having jurisdiction as proof of compliance that exterior hollow metal doors and frames have been tested and accepted for use at the wind load and design pressure level requirements specified for the Project.
- C. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. de La Fontaine Industries.
 - 4. Pioneer Industries, Inc.
 - 5. Republic Doors and Frames.
 - 6. Steelcraft; an Ingersoll-Rand company.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.02 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
- C. Hurricane Resistance: Provide exterior hollow metal doors and frames as complete and tested system, to meet the specified wind loads and design pressures, as detailed in the current code sections applicable to the Project; with Product Evaluations acceptable to authorities having jurisdiction.
- D. Windborne-Debris Impact Resistance: Provide exterior hollow metal doors and frames that pass missile-impact and cyclic-pressure tests according to ASTM E 1996 for Wind Zone 2. Test specimens shall be no smaller in width and length than doors indicated for use on Project.

1. Large-Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.

2.03 INTERIOR DOORS AND FRAMES

- A. General: Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 1. Physical Performance: Level A according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch.
 - d. Edge Construction: Model 1, Full Flush.
 - e. Core: Vertical steel stiffener.
 - f. Fire-Rated Core: Manufacturer's standard vertical steel stiffener or laminated mineral board core for fire-rated doors. Provide cores for temperature-rise rated doors where temperature rise rated doors are indicated on Drawings.
 3. Frames:
 - a. Materials: Uncoated, steel sheet, minimum thickness of 0.053 inch.
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Face welded.
 4. Exposed Finish: Prime.

2.04 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. General: Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
 1. Physical Performance: Level A according to SDI A250.4.
 2. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches
 - c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
 - d. Edge Construction: Model 2, Seamless.
 - e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - f. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - g. Core: Vertical steel stiffener, with manufacturer standard insulation.
 - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.7 deg F x h x sq. ft./Btu (U-Value 0.37) when tested according to ASTM C 1363.
 3. Frames:
 - a. Materials: Metallic-coated steel sheet; minimum thickness of 0.053 inch for doors up to 48 inches in width, and 0.067 inch for doors 48 inches and up in width; with minimum A40 coating.
 - b. Construction: Face welded.
 4. Exposed Finish: Prime.

2.05 BORROWED LITES

- A. General: Material and construction to match adjacent door frames.

2.06 HOLLOW-METAL PANELS

- A. General: Provide hollow-metal panels of same materials, construction, and finish as adjacent door assemblies.

2.07 FRAME ANCHORS

- A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.08 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

2.09 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
1. Coordinate locations of conduit and wiring boxes for electrical connections and access controls with Division 26 and Division 28 Sections.
 2. Comply with applicable requirements in SDI A250.6 for preparation of hollow metal work for hardware.
- B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
 2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches.
 4. Top Edge Closures: Close top edges of doors with flush closures, of same material as face sheets. Reinforce tops of doors with a continuous steel channel, extending the full width of the door and welded to the face sheet.
 5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets. Reinforce bottom of doors with a continuous steel channel, extending the full width of the door and welded to the face sheet.
 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
 7. Hardware Reinforcements: Fabricate according to SDI A250.6 with reinforcing plates from same material as door face sheets.
 8. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Corners: Fabricate frames, with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
 5. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 6. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
8. Electric Knock Out Boxes: Factory weld 18 gage minimum electric knock out boxes to frame for electric hardware preparations, such as but not limited to door position switches, electric strikes, card readers, and electric hinges. Knock out boxes shall comply with NFPA requirements.
9. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
 3. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Section 087100.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 4. Provide loose stops and moldings on inside of hollow-metal work.
 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.10 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.11 ACCESSORIES

- A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- thick, cold-rolled steel sheet set into 0.032-inch- thick steel frame.
 1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
 2. Fire-Rated Automatic Louvers: Louvers constructed with movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same qualified testing and inspecting agency that established fire-resistance rating of door assembly.
- B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
 - 1. Verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.)
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.
 - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Install door silencers in frames before grouting.
 - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
 - 3. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 - 4. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
 - 5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

- b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door (No Threshold): Maximum 3/4 inch
 - d. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - e. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.
- E. Thermal Insulation: Coordinate installation of foamed thermal insulation at shim spaces at frame perimeter as specified in Section 072100 "Thermal Insulation".
- F. Electrical and Access Control Connections: Coordinate installation of electrical connections to electrical hardware items, and access controls.

3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS**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. Solid-core doors and transom panels.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glass view panels in flush wood doors.
 - 2. Section 099123 "Interior Painting" for field finishing doors.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- 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.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
 - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
 - 2. Plastic laminate, 6 inches (150 mm) square, for each color, texture, and pattern selected.
 - 3. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - a. Provide Samples for each species of veneer and solid lumber required.
 - b. Provide Samples for each color, texture, and pattern of plastic laminate required.
 - c. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
 - 4. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.04 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that specializes in manufacturing the products specified in this section with minimum 5 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide VT Industries, Heritage Collection, or comparable product by one of the following manufacturers:
 - 1. Masonite Architectural.
 - 2. VT Industries, Inc.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.02 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ."
 - 1. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. Door Type:
 - 1. Commercial Wood Doors: Interior solid core doors, non-fire rated or fire rated as indicated on Drawings, with wood-veneer face for transparent finish or plastic-laminate-faced, as indicated on Drawings; 1-3/4 inch thick, unless otherwise indicated.
- C. WDMA I.S.1-A Performance Grade: WDMA Extra Heavy Duty.
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 - 2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 - 3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.

4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- F. Particleboard-Core Doors:
 1. Particleboard: ANSI A208.1, Grade LD-2.
 2. Blocking: Provide blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
 - a. 5-inch (125-mm) top-rail blocking in doors indicated to have closers.
 - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
 3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
 - a. Structural-Composite-Lumber-Core Doors:
 - 1) Structural Composite Lumber: WDMA I.S.10.
 - a) Screw Withdrawal, Face: 700 lbf.
 - b) Screw Withdrawal, Edge: 400 lbf.
- G. Mineral-Core Doors:
 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
 - a. 5-inch top-rail blocking.
 - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
 - c. 5-inch midrail blocking, in doors indicated to have armor plates.
 - d. 4-1/2-by-10-inch lock blocks or 5-inch midrail blocking, in doors indicated to have exit devices.
 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: As follows, per WDMA T.M.-10:
 - 1) Extra Heavy Duty: 550 lbf
 - 2) Heavy Duty: 475 lbf
 - 3) Standard Duty: 400 lbf

2.03 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
 1. Grade: Premium, with Grade A faces, no knots.
 2. Species: Select white birch.
 - a. Stain Color/Finish: Match VT Industries, Timber TI18.
 3. Cut: Rotary cut.
 4. Match between Veneer Leaves: Slip match.
 5. Pair and Set Match: Provide for doors hung in same opening, or separated only by mullions.
 6. Transom Match: Continuous match.
 7. Exposed Vertical Edges: Same species as faces or a compatible species.
 8. Core: Particleboard.
 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.
 10. WDMA I.S.1-A Performance Grade: As specified in "Flush Wood Doors, General" Article of this Section.

2.04 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, including premium colors and patterns.
 - 4. Exposed Vertical Edges: Impact-resistant polymer edging, applied after faces.
 - a. Polymer Edging Color: Same color as faces.
 - 5. Core: Particleboard.
 - 6. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before faces and crossbands are applied. Faces are bonded to core using a hot press.
 - 7. WDMA I.S.1-A Performance Grade: As specified in "Flush Wood Doors, General" Article of this Section.

2.05 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Manufacturer's standard shape.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.
- C. Metal Louvers:
 - 1. Blade Type: Vision-proof, inverted V or vision-proof, inverted Y.
 - 2. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with baked-enamel- or powder-coated finish to match door.
- D. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
 - 1. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with baked-enamel- or powder-coated finish to match door.

2.06 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
- D. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.07 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, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors that are indicated to receive transparent finish.
- C. Transparent Finish:
 1. Grade: Same grade for finish as specified for doors.
 2. Finish: WDMA TR-4 conversion varnish or WDMA TR-6 catalyzed polyurethane.
 3. Staining: Match Architect's sample.
 4. Sheen: Match Architect sample.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 1. Install fire-rated doors according to NFPA 80.
 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083113 - ACCESS DOORS AND FRAMES**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 access doors and frames for walls and ceilings.
- B. Related Requirements:
 - 1. Section 077200 "Roof Accessories" for roof hatches.
 - 2. Division 23 "Heating, Ventilation, and Air Conditioning" for heating and air-conditioning duct access doors.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Indicate position of all access door units.
- C. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.
- D. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.04 PRODUCT HANDLING

- A. Built-In Items: Promptly deliver components to be built-in supporting structure. Furnish final reviewed setting drawings, diagrams, templates and instructions for installation of built-in components
- B. Keys: At completion of work, submit keys for access doors to Owner.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.02 ACCESS DOORS AND FRAMES

- A. General: Provide access doors where equipment, devices, controls and like items to which access is required for periodic adjustment, servicing, replacement or maintenance are located behind finish construction or concealed in construction. Equipment, devices, controls and like items include, but are not limited to valves, traps, coils, dampers and pull boxes.
 - 1. Coordination: Coordinate location, type and size of access doors with work requiring door and type work in which door is to be installed. Location, type and size of access doors shall be acceptable to Architect.
 - 2. Door Size: Access doors shall be of sufficient size to make possible periodic adjustment, servicing, replacement or maintenance of equipment, devices, controls and like items located behind finish construction or concealed in construction through opening of access door. If size is not indicated on Drawings, provide door size for locations as follows:
 - a. Walls: 12 inches x 12 inches.
 - b. Ceilings: 24 inches x 24 inches.
- B. Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Larsens Manufacturing Company.
 - f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - g. Nystrom, Inc.
 2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 3. Locations: Masonry and concrete walls.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
 5. Frame Material: Same material, thickness, and finish as door.
 6. Latch and Lock: Cam latch, screwdriver operated, with interior release.
- C. Flush Access Doors with Concealed Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Larsens Manufacturing Company.
 - f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - g. Nystrom, Inc.
 2. Description: Face of door flush with frame; with concealed flange for gypsum board and plaster installation and concealed hinge.
 3. Locations: Walls and ceilings in gypsum board assemblies.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
 5. Frame Material: Same material and thickness as door.
 6. Latch and Lock: Cam latch, screwdriver operated, with interior release.
- D. Recessed Access Doors with Concealed Flanges:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Larsens Manufacturing Company.
 - f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - g. Nystrom, Inc.
 2. Description: Door face recessed depth as required for gypsum board infill; with concealed flange for gypsum board installation and concealed hinge.
 3. Locations: Walls and ceilings in gypsum board assemblies.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
 5. Latch and Lock: Cam latch, screwdriver operated, with interior release.
- E. Recessed Access Doors with Concealed Flanges For Tile:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Larsens Manufacturing Company.
 - f. Milcor; Commercial Products Group of Hart & Cooley, Inc.

- g. Nystrom, Inc.
 - 2. Description: Door face recessed depth as required for tile infill; with concealed flange for gypsum board with tile finish installation, and concealed hinge.
 - 3. Locations: Walls in gypsum board assemblies with tile finish.
 - 4. Stainless-Steel Sheet for Door: Nominal 0.062 inch, 16 gage, No. 4 finish.
 - 5. Latch and Lock: Latch bolt, knurled-knob operated, with interior release.
- F. Exterior Flush Access Doors:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Babcock-Davis.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Karp Associates, Inc.
 - d. Larsens Manufacturing Company.
 - e. Nystrom, Inc.
 - 2. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2-inch-thick fiberglass insulation.
 - 3. Locations: Wall.
 - 4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory primed.
 - 5. Frame Material: Same material, thickness, and finish as door.
 - 6. Latch and Lock: Cam latch operated by handle, with preparation for mortise lock; with interior release.

2.03 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, Flush Access Doors with Exposed Flanges:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Larsens Manufacturing Company.
 - f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
 - g. Nystrom, Inc.
 - 2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal for temperature rise rated doors, or uninsulated for non-temperature rise rated doors; with exposed flange, self-closing door, and concealed hinge.
 - 3. Locations: Walls in concrete and masonry construction requiring a fire rating.
 - 4. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 5. Temperature-Rise Rating: 250 deg F at the end of 30 minutes.
 - 6. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage, factory primed.
 - 7. Frame Material: Same material, thickness, and finish as door.
 - 8. Latch and Lock: Self-latching door hardware, operated by knurled-knob with interior release.
- B. Fire-Rated, Flush Access Doors with Concealed Flanges:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. Babcock-Davis.
 - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - d. Karp Associates, Inc.
 - e. Nystrom, Inc.

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal for temperature rise rated doors, uninsulated for non-temperature rise rated doors; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Wall and ceilings in gypsum board assemblies.
4. Fire-Resistance Rating: Not less than that of adjacent construction.
5. Temperature-Rise Rating: 250 deg F at the end of 30 minutes.
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage, factory primed.
7. Frame Material: Same material, thickness, and finish as door.
8. Latch and Lock: Self-closing, self-latching door hardware, operated by knurled-knob, with interior release.

2.04 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.
- D. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.
- E. Frame Anchors: Same material as door face.
- F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.05 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
- E. Latch and Lock Hardware:
 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
 2. Keys: Furnish two keys per lock and key all locks alike.
 3. Mortise Cylinder Preparation: Where indicated, prepare door panel to accept cylinder specified in Section 087100 "Door Hardware."

2.06 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- E. Stainless-Steel Finishes:
 1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
 2. Polished Finish: No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - a. Run grain of directional finishes with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates 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. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install frames and doors at fire rated openings meeting requirements of ICC - International Building Code and NFPA 80, and meeting terms of fire rated listing.
- C. Install frames plumb and level in openings. Secure rigidly in place.

3.03 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION

SECTION 083613 - SECTIONAL DOORS**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. Electrically operated, full-vision, aluminum sectional doors.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for miscellaneous steel supports.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type and size of sectional door and accessory.
 - 1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For units with factory-applied finishes.
 - 1. Include Samples of accessories involving color selection.
- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes, illustrating color and texture:
 - 1. Flat door sections.
 - 2. Frame for paneled door sections; of each width of stile and rail required.
 - 3. Panel for raised-panel door sections; not smaller than required to show raised-panel profile.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Evaluations: Provide copy of current Product Evaluation acceptable to authorities having jurisdiction as proof of compliance that exterior sectional doors have been tested and accepted for use at the wind load and design pressure level requirements specified for the Project.
- C. Sample Warranties: For special warranties, including project specific requirements and warranty period.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sectional doors to include in maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer specializing in manufacturing the products specified in this section with minimum three years of documented experience .
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
- C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

1.07 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Failure of components or operators before reaching required number of operation cycles.
 - c. Faulty operation of hardware.
 - d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
 - e. Delamination of exterior or interior facing materials.
 - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Special Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 MANUFACTURERS, GENERAL**

- A. Source Limitations: Obtain sectional doors from single source from single manufacturer.
 - 1. Obtain operators and controls from sectional door manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. General Performance: Sectional doors shall comply with performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
 - 1. Design Wind Load: As indicated on Drawings.
 - 2. Testing: According to ASTM E 330 or DASMA 108 for garage doors and complying with the acceptance criteria of DASMA 108.
 - 3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
 - a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of the door width.
 - b. Deflection of horizontal track assembly shall not exceed 1/240 of the door height.
- C. Hurricane Resistance: Provide exterior sectional doors as complete and tested system, to meet the specified wind loads and design pressures, as detailed in the current code sections applicable to the Project; with Product Evaluations acceptable to authorities having jurisdiction.
- D. Windborne-Debris Impact Resistance: Provide glazed and impact-protective sectional doors that pass missile-impact and cyclic-pressure tests according to ASTM E 1996 for Wind Zone 2. Test specimens shall be no smaller in width and length than doors indicated for use on Project.
 - 1. Large-Missile Test: For overhead coiling doors located within 30 feet (9.144 m) of grade.

2.03 DOOR ASSEMBLY, FULL-VISION ALUMINUM

- A. Full-Vision Aluminum Sectional Door: Sectional door formed with hinged sections and fabricated according to DASMA 102 unless otherwise indicated, springless design not requiring counterbalance.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Model 521S Full View Aluminum Door (with High Wind Load Option), or comparable product by one of the following:
 - a. Overhead Door Corporation.
 - b. Wayne-Dalton Corp.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Speed: Standard speed, not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec.
- D. Air Infiltration: Maximum rate of 0.08 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E 283.
- E. Installed R-Value: Minimum 2.75 deg F x h x sq. ft./Btu.
- F. Aluminum Sections: Full vision, insulated, flush aluminum sections.
- G. Weatherseals: Fitted to bottom and top and around entire perimeter of door. Provide combination bottom weatherseal and sensor edge.
- H. Glazing Sections: Full-vision aluminum sections, with glazing units as follows:
 - 1. Clear Polycarbonate Plastic: 6-mm (1/4 inch) thick, transparent, fire-retardant, UV-resistant, polycarbonate sheet manufactured by extrusion process, and meeting requirements of Product Evaluation.
- I. Counterbalance Type: Springless, not required.
- J. Electric Door Operator:
 - 1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
 - 2. Operator Type: Manufacturer's standard direct-drive, wall mounted operator meeting performance requirements. Bar mounted, trolley operators are not allowed.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
 - 4. Motor Exposure: Exterior, dusty, wet, or humid.
 - 5. Emergency Manual Operation: Chain type.
 - 6. Control Station:
 - a. Mounting Location: Interior-side mounted.
 - b. Exposure: Interior mounted, but with exterior, dusty, wet, or humid.
 - c. Actuator: Three-button control station; with constant contact closing, and stop and reverse function; momentary contact opening.
- K. Curtain Accessories: Equip door with weatherseals.
- L. Door Finish: Powder-coat finish.

2.04 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.05 ALUMINUM DOOR SECTIONS

- A. Sections: Extruded-aluminum stile and rail members with dimensions and profiles as indicated on Drawings; members joined by welding or with concealed, 1/4-inch- minimum diameter, aluminum or nonmagnetic stainless-steel through bolts, full height of door section; and with meeting rails shaped to provide a weather-resistant seal.
 - 1. Aluminum: ASTM B 221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; minimum thickness 0.065 inch for door section 1-3/4 inches deep, and as required to comply with requirements.

2. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.
 3. Provide reinforcement for hardware attachment.
- B. Solid Panels: Aluminum sheet, complying with ASTM B 209 , alloy and temper standard with manufacturer for type of use and finish indicated, not less than 0.050 inch thick, set in continuous vinyl channel retained with rigid, snap-in, extruded-vinyl moldings or with rubber or neoprene glazing gasket with aluminum stop.
- C. Full-Vision Sections: Manufacturer's standard, tubular, aluminum-framed section fully glazed with glazing set in vinyl, rubber, or neoprene glazing channel and with removable extruded-vinyl or aluminum stops.

2.06 TRACKS, SUPPORTS, AND ACCESSORIES

- A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances indicated on Drawings, Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides for required door type, size, weight, and loading.
1. Galvanized Steel: ASTM A 653/A 653M, minimum G60 zinc coating.
 2. Slope tracks at an angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.
 3. Track Reinforcement and Supports: Galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.
 - a. For Vertical Track: Continuous reinforcing angle attached to track and attached to wall with jamb brackets.
 - b. For Horizontal Track: Continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.
- B. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and top of sectional door unless otherwise indicated.

2.07 HARDWARE

- A. General: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.
- B. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch- nominal coated thickness at each end stile and at each intermediate stile, according to manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible. Provide double-end hinges where required, for doors more than 16 feet wide unless otherwise recommended by door manufacturer.
- C. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- diameter roller tires for 3-inch- wide track and 2-inch- diameter roller tires for 2-inch- wide track.

2.08 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and "operation cycles" requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
1. Comply with NFPA 70.
 2. 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.

- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door-Operator Type: Unit consisting of electric motor, gears, and controls needed to operate door and meet required usage classification.
- D. Door Operator Location: Wall mounted, operator location indicated on Drawings for each door. Bar mounted, trolley operators are not allowed.
- E. Motors: Direct-drive, integrated gear/motor brake assembly, reversible-type with controller (disconnect switch) for motor exposure and opening size indicated.
 - 1. Motor Size - Standard Speed: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
 - 4. Use adjustable motor-mounting bases for belt-driven operators.
- F. Limit Switches: Equip motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- G. Control Station: Provide electronic variable frequency drive controller with microprocessor self-diagnostics. Two line LCD readout indicates door action, alarm conditions, and fault conditions. Time delay self close timer and non-resettable cycle counter shall be included.
 - 1. Three-Button Control Station: Three-button control station in fixed location with push-button controls labeled "Open" and "Stop". Closing to be sustained- or constant-pressure push-button control labeled "Close", with stop and reverse upon release of constant-pressure. "Stop" to be stop and reverse. "Open" to be momentary-contact.
 - 2. Enclosures - Exterior, Dusty, Wet or Humid Locations: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure
- H. Emergency Manual Operation: Equip electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.09 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

- A. Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.
 - 1. Color: White or gray, as selected by Architect from standard range of manufacturer.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION

- A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- C. Fit and align assembly, including hardware, level and plum to provide smooth operation.
- D. Tracks:
 - 1. Fasten vertical track assembly to opening jambs and framing, spaced not more than 24 inches apart.
 - 2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.
- E. Coordinate installation with electrical service. Complete wiring from disconnect to unit components.
- F. Install sealants at frame perimeter meeting requirements of Section 079200 "Joint Sealants".
- G. Install perimeter trim and closures.
- H. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.
- I. Power-Operated Doors: Install according to UL 325.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
 - 1. Maximum Variation from Plumb: 1/16 inch.
 - 2. Maximum Variation From Level: 1/16 inch.
 - 3. Longitudinal or Diagonal Warp: Plus or minus 1/8 per 10 foot straight edge.

3.04 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

3.05 CLEANING AND PROTECTION

- A. Remove labels and visible markings. Clean installed components.
- B. Protect installed products from during construction.
- C. Do not permit construction traffic through overhead door openings after adjustments have been made and door cleaned.

END OF SECTION

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS**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. Exterior and interior storefront framing.
 - 2. Storefront framing for punched openings.
 - 3. Exterior and interior manual-swing entrance doors and door-frame units.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site before starting work of this section to review conditions associated installation of storefront system. Meeting shall include, at minimum, agenda items specified in this paragraph. Participants shall include Owner, Architect, Contractor, installer of work under this section, and installers of related work. Record discussions of meeting and furnish a copy of record to each participant.
 - 1. Work schedule, including projected timeline for mockups and field testing.
 - 2. Warranty provisions and requirements.
 - 3. Required quality assurance and quality control procedures, testing and inspections.
 - 4. Code considerations.
 - 5. Review preparation and installation procedures, and coordinating and scheduling required with related work.
 - 6. Review flashing details, details where storefront connect with other components of exterior enclosure system, and any special and unique details and conditions.
 - 7. Tie-ins with air and weather barrier systems.
 - 8. Support structure conditions, including loading limitations.
 - 9. Temporary conditions, and procedures for coping with inclement weather.
 - 10. Protection of complete work.

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 and storefronts. 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:

1. For each type of exposed finish required, in manufacturer's standard sizes.
 2. Exposed to view joint sealants, glazing sealants, and tapes.
- E. Product Schedule: For aluminum-framed doors, including hardware schedule. Use same designations indicated on Drawings.
1. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts.
1. Certification: Shop drawings shall be signed and stamped by Professional Structural Engineer.
 2. Calculations: Submit signed and stamped structural calculations for the work. Submittal will be for information only.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. 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 type aluminum-framed entrance and storefront.
- C. Energy Performance Tests and Modeling Reports: Perform project specific thermal tests in accordance with NFRC 102, or provide finite element computer thermal modeling and calculations per NFRC 100, NFRC 200, NFRC 705 or AAMA 507, using DOE/LBL THERM, WINDOW, and/or CMAST software. Submit reports for each type entrance and storefront system.
1. Data derived from calculations, theoretical assumptions and test results of different size or arrangement of entrance and storefront, or with glazing units different from those required for the Work, is not acceptable.
- D. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency, or.
- E. Product Evaluations: Provide copy of current Product Evaluation acceptable to authorities having jurisdiction as proof of compliance that aluminum-framed entrances and storefronts have been tested and accepted for use at the wind load and design pressure level requirements specified for the Project.
- F. Sample Warranties: For special warranties, including project specific requirements and warranty period.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum-framed entrance and storefronts that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations; with minimum 5 years of documented experience.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, and have 5 years minimum experience documented experience in designing, detailing and installing products specified in this Section.

- C. 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 construction.
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.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Handle products of this Section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 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. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: 5 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 D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: 20 years from date of Substantial Completion.
- C. Special Project Warranty: Submit Installer's warranty, signed by Installer, covering the Work of this Section, including all components of entrance and storefront system, for the following warranty period:
 1. Warranty Period: 2 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 014000 "Quality 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 uniformly distributed and 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: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
- D. Deflection of Framing Members: At design wind pressure, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
 - 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 - 3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
 - a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans less than 11 feet 8-1/4 inches.
- E. Structural: Test according to ASTM E 330 as follows:
 - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
 - 1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 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.
- G. Water Penetration under Static Pressure: Test according to ASTM E 331 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 8 lbf/sq. ft.
- H. Energy Performance: Certify and label energy performance according to NFRC as follows:
 - 1. Fixed Framing and Glass Area:
 - a. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.50 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.

- c. Condensation Resistance: No uncontrolled nor visible condensation in the form of liquid water, ice or frost shall form on any interior metal surface of the entrance and storefront systems at the outdoor design air temperature, indoor design air temperature, and indoor design relative humidity indicated for the Work.
- 2. Entrance Doors:
 - a. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.83 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 - b. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.25 as determined according to NFRC 200.
 - c. Condensation Resistance: No uncontrolled nor visible condensation in the form of liquid water, ice or frost shall form on any interior metal surface of the entrance doors at the outdoor design air temperature, indoor design air temperature, and indoor design relative humidity indicated for the Work.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- J. Accessibility Requirements:
 - 1. Swinging door surfaces within 10 inches of finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door.
 - a. Entrance doors having a bottom rail with the top leading edge tapered at 60 degrees minimum from the horizontal are exempt from the 10-inch bottom-rail height requirement.
 - 2. Opening Force Requirements: All doors and operable fenestration shall have opening force and closing speed requirements meeting accessibility guidelines. Adjust hardware as required to meet accessibility requirements if installed components do not meet guidelines.

2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kawneer North America.
 - 2. Oldcastle BuildingEnvelope.
 - 3. Wausau Window and Wall Systems.
 - 4. YKK AP America Inc.
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing, doors, louvers 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.
 - a. Thermally Broken Construction: Fabricate framing with an integral, concealed, low-conductance thermal break located between exterior and interior surfaces in a manner that eliminates direct metal-to-metal contact.
 - b. Interior Storefront: Framing members for interior applications are not required to be thermally broken or thermally improved, and may be nonthermal.
 - 2. Glazing System: Retained mechanically with gaskets on four sides.
 - 3. Glazing Plane: Front.
 - 4. Finish: Color anodic finish.
 - 5. Fabrication Method: Field-fabricated or shop-fabricated stick system.

- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction, to allow for backer rod and sealant installation.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. High Performance Subsill: Extruded aluminum high performance subsill receptor of manufacturer, with end dams/caps to prevent water from draining off ends of subsill.
- E. 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 B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.
 - 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.
 - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
 - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
 - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.04 ENTRANCE DOOR SYSTEMS

- A. Exterior Entrance Doors: Manufacturer's standard glazed exterior entrance doors for manual-swing operation.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kawneer North America.
 - b. Oldcastle BuildingEnvelope.
 - c. Wausau Window and Wall Systems.
 - d. YKK AP America Inc.
 - 2. 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.
 - 3. Door Design: As indicated.
 - 4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. For doors with a bottom rail less than 10 inches high, provide tapered profile at 60 degrees minimum from the horizontal to meet accessibility requirements.
- B. Interior Entrance Doors: Manufacturer's standard glazed interior entrance doors for manual-swing operation.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C.R. Laurence Co., Inc.; U.S. Aluminum.
 - b. Kawneer North America.
 - c. Oldcastle BuildingEnvelope.
 - d. Wausau Window and Wall Systems.
 - e. Wilson Partitions.
 - f. YKK AP America Inc.

2. 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.
3. Door Design: As indicated.
4. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
 - a. For doors with a bottom rail less than 10 inches high, provide tapered profile at 60 degrees minimum from the horizontal to meet accessibility requirements.

2.05 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."
- B. Weather Stripping: Manufacturer's standard replaceable components.
 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- C. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- D. Silencers: BHMA A156.16, Grade 1.
- E. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

2.06 GLAZING

- A. General: Comply with Section 088000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of resilient elastomeric glazing gaskets, setting blocks, and shims or spacers, complying with Section 088000 "Glazing."
 1. Color: As selected by Architect from full range of manufacturer.
- C. Glazing Sealants: As recommended by manufacturer, and complying with Section 088000 "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. Reinforce members as required to receive fastener threads.
 3. Where exposed fasteners are unavoidable, use fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch 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, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.
- C. Exposed Flashing: Aluminum sheet, 0.032 inch thick, finished to match framing members.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- E. Perimeter Joint Sealant: As specified in Section 079200 "Joint Sealants."
- F. Insulating Materials: As specified in Section 072100 "Thermal Insulation."

- G. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-milthickness per coat.

2.08 FABRICATION

- A. Steel Reinforcing: Provide extruded aluminum framing members with internal reinforcement of structural steel members, as required to meet structural performance requirements.
- B. Form or extrude aluminum shapes before finishing.
- C. 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.
- D. 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 isolation 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.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- E. Water Penetration: Fabricate components to resist water penetration by one of following methods:
1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within storefront to exterior.
 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of storefront system and secondary seal weeped and vented to exterior.
- F. Provide water deflectors at intermediate horizontals to drain water down into verticals and out of system.
- G. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- H. 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.
 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- I. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 2. At exterior doors, provide weather sweeps applied to door bottoms.
- J. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- K. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.09 ALUMINUM FINISHES

- A. High-Performance Organic Finish - Two-Coat Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: White or gray, as selected by Architect from standard range of manufacturer.

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. Verify dimensions, tolerances, and method of attachment with other work.
- C. Verify wall opening dimensions allow for a manufacturer acceptable installation of storefront system, warrantable perimeter sealant joint configuration, and provides adequate clearance between sill end dam and wall opening for a perimeter sealant joint.
- D. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.
- E. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's written instructions.
 - 2. Do not install damaged components.
 - 3. Fit joints to produce hairline joints free of burrs and distortion.
 - 4. Rigidly secure nonmovement joints.
 - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
 - 6. At perimeter joints and other joints indicated to receive joint sealant, maintain a 1/2 inch nominal joint width with no joints less than 1/4 inch width for application of sealant.
 - 7. Seal perimeter and other joints watertight unless otherwise indicated.
- B. 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 or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.
 - 1. Turn up ends and edges of sill flashings; seal to adjacent work to form water tight dam.
 - 2. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- D. Subsill: Install subsill, with end dams sealed to direct water draining from jamb down into subsill and out weeps, away from the interior of the building. Shim to level and to allow weeps to drain properly and install perimeter sealant meeting requirements of Section 079200 "Thermal Insulation," without clogging weeps.
- E. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 - 1. Install water deflectors at intermediate horizontals to drain water down into verticals and out of system.
- F. Air Barrier Seal: Coordinate attachment and seal of perimeter air barrier materials.
- G. Insulation: Coordinate installation of insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier, as specified in Section 072100 "Thermal Insulation."
- H. Install components plumb and true in alignment with established lines and grades.
- I. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- J. Install glazing as specified in Section 088000 "Glazing."

- K. 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 manufacturers' written instructions using concealed fasteners to greatest extent possible.
 - 3. Set thresholds in bed of mastic and secure.
- L. Install louvers and associated flashings in accordance with 089119 "Fixed Louvers."
- M. Install perimeter sealant in accordance with Section 079200 "Joint Sealants."
 - 1. Tie-in sealant to air or weather barrier to maintain continuity and provide weathertight air or weather barrier system.
 - 2. Maintain 1/2 inch nominal joint width, with joints no less than 1/4 inch.

3.03 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections, and assist Contractor with diagnosis of test specimen and perimeter joint sealants, in the event of failures. Testing agency shall prepare reports and submit to Contractor with copy to Owner, and Architect.
- B. Pre-Testing Meeting: Include Owner, Architect, Contractor, installing subcontractors, manufacturer technical representative, and testing agency to review relevant pre-installation meeting minutes and to discuss testing scope, locations, frequency, Contractor's field quality control plan, and to verify all systems are designed to withstand specified testing requirements.
- C. Field Quality-Control Testing: Perform the following test on representative areas of aluminum-framed entrances and storefronts. Testing shall be conducted as early into the schedule as is practical.
 - 1. Test Areas:
 - a. Test areas to include head, jamb, sill, spandrel glass interface (if applicable), outside corner, inside corner, transition to operable windows (if applicable), storefront system opening perimeter sealant joint, and other locations as selected by Architect and testing agency. Test only after perimeter sealants have cured.
 - b. All interior gypsum board and finishes to be left uninstalled or removed prior to testing to allow for visual access to interior perimeter joint of storefront system.
 - c. To allow visual access to the outside primary seal and storefront frame perimeter, do not install interior perimeter joint sealant. If interior sealant line is required by storefront system manufacturer to maintain continuity of air or weather barrier or the storefront system itself, it shall remain in place during air and water testing. Upon completion of water testing, portions of the interior sealant line shall be removed as directed by the Architect to provide visual access to the storefront frame perimeter and the exterior perimeter weather sealant joints.

2. Testing Frequency and Location: Perform a minimum of two tests in areas as directed by Architect and testing agency, unless otherwise indicated.
3. Testing:
 - a. 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.
 - 1) Allowable Water Infiltration: No water penetration. Water penetration, or water leakage, is defined as any water penetrating assemblies or water that appears on any indoor surface of the fenestration product from sources other than condensation.
- D. Remedial Work: Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
 1. Repair or remove and replace work where test results and inspections indicate that it does not comply with specified requirements.
 2. If the field test reveals leakage, points of entry and paths of flow of water shall be identified, analyzed, and necessary remedial work shall be established, subject to Architect's review and comment.
 3. Repairs and/or modifications shall be made and, after adequate curing of all sealants, re-test to successful conclusion.
 4. Any resulting repairs due to systemic storefront or installation issues shall be made to both installed storefront and storefront yet to be installed, as required.
- E. Additional Testing and Inspections: Additional testing and inspections of repaired and/or replaced fenestration units to determine compliance with the specified performance requirements shall be performed at the Contractor's expense.
 1. Testing of repaired fenestration shall occur on one or more units at the discretion of the Owner and Architect.

3.05 ADJUSTING

- A. Adjust doors, operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

3.06 CLEANING AND PROTECTION

- A. Clean framing and glazing meeting instructions and recommendations of manufacturer. Remove dirt from all corners.
- B. Remove excess sealant by method acceptable to sealant manufacturer.
- C. Protect installed products from damage during subsequent construction.
- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.
- E. Touch-Up:
 1. General: Touch-up or restore damaged work so there is no evidence of corrective work as acceptable to Architect. If work is not acceptable to Architect, remove and replace damaged units.
 2. Coatings: Clean and touch-up minor abrasions in finish coatings with air dried coating that is compatible with and matches type, color and sheen of factory applied coating and blends with initial surface.
- F. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION

SECTION 087100 - DOOR HARDWARE**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. Mechanical door hardware for the following:
 - a. Swinging doors.
 - 2. Electrified door hardware.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies.
 - 2. Section 081416 "Flush Wood Doors" for astragals and integral intumescent seals provided as part of labeled fire-rated assemblies.
 - 3. Section 083323 "Overhead Coiling Doors" for door hardware provided as part of overhead coiling door assemblies.
 - 4. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrance door hardware provided as part of entrance and storefront assembly.
 - 5. Division 28 "Electronic Safety and Security" for access control devices installed at door openings and provided as part of a security system.
 - 6. Division 28 "Electronic Safety and Security" for detection devices installed at door openings and provided as part of an intrusion-detection system.
 - 7. Division 28 "Electronic Safety and Security" for connections to building fire-alarm system.

1.03 COORDINATION

- A. Floor-Recessed Door Hardware: Coordinate layout and installation with floor construction.
 - 1. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory 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.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

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 electrified door hardware.
 - 1. Include diagrams for power, signal, and control wiring.
 - 2. Include details of interface of electrified door hardware and building safety and security systems.

- C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Submittal Sequence: Submit door hardware schedule submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 - 3. Content: Include the following information:
 - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
 - e. Fastenings and other installation information.
 - f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - g. Mounting locations for door hardware.
 - h. List of related door devices specified in other Sections for each door and frame.

1.05 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Certificates: For each type of electrified door hardware.
 - 1. Certify that door hardware for use on each type and size of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- D. Sample Warranty: For special warranty, including project specific requirements and warranty period.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals.
- B. Schedules: Final door hardware and keying schedule.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Specified manufacturers only.
- B. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- C. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware with five years of experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1.09 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
 - 2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Exit Devices: Five years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.
 - c. Concealed Floor Closers: Five years from date of Substantial Completion.
 - d. Mortise Locks and Latches: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Source Limitations: Obtain each type of door hardware from single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of at the tested pressure differential of of water.
- C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "ADA Standards for Accessible Design" and ICC A117.1.
 - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 - 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.

4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.03 SCHEDULED DOOR HARDWARE

- A. Provide all hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.
- B. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
 1. Door hardware is scheduled on Drawings.
- C. Electrically Operated and/or Controlled Hardware: Provide all power supplies, power transfer hinges, relays, and interfaces required for proper operation; provide wiring between hardware and control components and to building power connection.
- D. Function: Lock and latch function numbers and descriptions of manufactures series as listed in hardware schedule.

2.04 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. McKinney Products Company; an ASSA ABLOY Group company.
 2. Quantity of Hinges Per Door: As follows, but not less than required by manufacturer:
 - a. Doors up to 60 inches High: Two hinges.
 - b. Doors From 60 inches High up to 90 inches High: Three hinges.
 - c. Doors 90 inches High up to 120 inches High: Four hinges.
 - d. Doors over 120 inches High: One additional hinge per each additional 30 inches in height greater than 120 inches.
 3. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'-0": 4-1/2 inches standard or heavy weight as specified.
 - b. Sizes from 3'-1" to 4'-0": 5 inches standard or heavy weight as specified.
 4. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing hinges unless Hardware Sets indicate heavy weight.
 5. Hinge Options:
 - a. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
 - b. Provide ball-bearing hinges at all doors.
 - c. Provide non-removable pins on exterior outswinging doors and outswinging access controlled doors.
 6. Electrified Functions for Hinges:
 - a. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
 - b. Monitoring: Concealed electrical monitoring switch.
 7. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.

2.05 CENTER-HUNG AND OFFSET PIVOTS

- A. Center-Hung and Offset Pivots: BHMA A156.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

2.06 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches ; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. McKinney Products Company; an ASSA ABLOY Group company.

2.07 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 2. Deadbolts: Minimum 1-inch bolt throw.
- C. Lock Backset: 2-3/4 inches unless otherwise indicated.
- D. Lock Trim:
 1. Description: As indicated on Drawings.
 2. Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
 3. Dummy Trim: Match lever lock trim and escutcheons.
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
 4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.
- F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - c. SARGENT Manufacturing Company; ASSA ABLOY.
- G. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Best Access Systems; Stanley Security Solutions, Inc.
 - c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - d. SARGENT Manufacturing Company; ASSA ABLOY.

2.08 AUXILIARY LOCKS

- A. Bored Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Best Access Systems; Stanley Security Solutions, Inc.
 - c. SARGENT Manufacturing Company; ASSA ABLOY.
- B. Mortise Auxiliary Locks: BHMA A156.36; Grade 1; with strike that suits frame.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Best Access Systems; Stanley Security Solutions, Inc.
 - c. SARGENT Manufacturing Company; ASSA ABLOY.

2.09 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade 1; with faceplate to suit lock and frame.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. HES, Inc.; an ASSA ABLOY Group company.
 - c. Securitron Magnalock Corporation; an ASSA ABLOY Group company.

2.10 ELECTROMECHANICAL LOCKS

- A. Electromechanical Locks: BHMA A156.25; Grade 1; motor or solenoid driven; with strike that suits frame.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. SARGENT Manufacturing Company; ASSA ABLOY.
 - 2. Type: As indicated in Door Hardware Schedule.

2.11 EXIT LOCKS AND EXIT ALARMS

- A. Exit Locks and Alarms: BHMA A156.29, Grade 1, surface mounted, battery powered, housed in metal case; with red-and-white lettering reading "EMERGENCY EXIT PUSH TO OPEN--ALARM WILL SOUND." Include the following features:
 - 1.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Arrow USA; an ASSA ABLOY Group company.
 - 2. SARGENT Manufacturing Company; ASSA ABLOY.

2.12 FLUSH BOLTS, GENERAL

- A. Floor Bolts: Provide BHMA A156.16, Grade 1 dustproof strike, except at metal thresholds.
- B. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
- C. Surface bolts to be minimum 8 inches in length and UL Listed for Labeled fire doors where applicable.
- D. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

2.13 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
 - b. Allegion plc.

2.14 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Hiawatha, Inc; a division of the Activar Construction Products Group.

2.15 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3, Grade 1.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adams Rite Manufacturing Co; an ASSA ABLOY Group company.
 - b. Allegion plc.
 - c. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 2. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
 3. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
 4. Removable Mullions: BHMA A156.3.
 5. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.
 6. Electronic Exit Bars: Nonlatching electronic releasing device, activated by an adjustable capacitance sensor, with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device and 16 feet of cord to route wiring off the door frame.
 7. Outside Trim: Design, material and finish to match locksets, unless otherwise indicated.

2.16 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.
- B. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.17 KEYING

- A. By Owner.

2.18 OPERATING TRIM

- A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
 2. Provide push and pull on doors not specified to have lockset, latchset, exit device, or auxiliary lock.
 3. On solid doors, provide matching push plate and pull plate on opposite faces.

4. On glazed storefront doors, provide matching push/pull bars on both faces.

2.19 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release; and with internal override.
- B. Carry-Open Bars: BHMA A156.3; prevent the inactive leaf from opening before the active leaf; provide polished brass or bronze carry-open bars with strike plate for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
- C. Astragals: BHMA A156.22.

2.20 CLOSERS, GENERAL

- A. Closers: Complying with BHMA A156.4, Grade 1 (Heavy Duty) closers, one piece cast iron or aluminum alloy body construction; with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use on fire rated doors.
 1. Provide surface-mounted, door-mounted closers unless otherwise indicated.
 2. Provide a door closer on every exterior door.
 3. Provide a door closer on every fire- and smoke-rated door. Spring hinges are not an acceptable self-closing device unless specifically so indicated.
 4. On pairs of swinging doors, if an overlapping astragal is present, provide coordinator to ensure the leaves close in proper order.
- B. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use.
- C. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in door hardware schedule.
 1. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
 2. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
 3. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
- D. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door hardware schedule.

2.21 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Corbin Russwin, Inc.; an ASSA ABLOY Group company.
 - c. Norton Door Controls; an ASSA ABLOY Group company.
 - d. SARGENT Manufacturing Company; ASSA ABLOY.

2.22 CONCEALED CLOSERS

- A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Norton Door Controls; an ASSA ABLOY Group company.
 - c. SARGENT Manufacturing Company; ASSA ABLOY.

2.23 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

2.24 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. SARGENT Manufacturing Company; ASSA ABLOY.

2.25 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co.
 - c. Reese Enterprises, Inc.
 - d. Zero International, Inc.
- B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg , as follows:
 - 1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
 - 2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
 - 3. Gasketing on Double Doors: 0.50 cfm per foot of door opening.
- C. Smoke-Rated Gasketing: On each door in smoke partition, provide smoke gaskets; top, sides, and meeting stile of pairs.
 - 1. Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 2. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
 - 3. If fire/smoke partitions are not indicated on drawings, provide smoke gaskets on each door identified as a "smoke door" and 20-minute rated fire doors.
- D. Fire-Rated Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies

2. Fire Rated Wood Doors: On wood doors with fire rating more than 20-minutes, provide frame-applied intumescent gaskets.
- E. Exterior Doors:
1. On each exterior door, provide continuous weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles of pairs.
 2. Where exterior door is also required to have fire or smoke rating, provide gaskets functioning as both smoke and weather seals.
 3. On each exterior door, provide door bottom sweep, unless otherwise indicated.
- F. Acoustical Gasketing: On doors indicated as "sound-rated", "acoustical", or with an STC rating, provide sound-rated gaskets and automatic door bottom; make gaskets completely continuous, do not cut or notch gaskets for installation.
1. Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

2.26 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. National Guard Products, Inc.
 - b. Pemko Manufacturing Co.
 - c. Reese Enterprises, Inc.
 - d. Zero International, Inc.

2.27 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Rockwood Manufacturing Company; an ASSA ABLOY Group company.

2.28 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allegion plc.
 - b. Rockwood Manufacturing Company; an ASSA ABLOY Group company.
 2. Drip Guard: Provide projecting drip guard over all exterior doors unless they are under a projecting roof or canopy.
 3. Silencers: Neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.
 - a. Provide 3 for single doors, and 2 for pairs of doors.
 - b. Omit where adhesive mounted seals occur.
 - c. Leave no unfilled or uncovered pre-punched silencer holes.

2.29 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.
1. Manufacturer's identification is permitted on rim of lock cylinders only.

- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 - 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
 - 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
 - 4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
 - 5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.30 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
 - 1. If finish is not indicated in door hardware schedule, provide satin oxidized bronze, oil rubbed, on bronze base metal, 613 (approx US10B) for interior applications, and satin stainless steel 630 (US32D) for exterior applications.
 - 2. Exceptions:
 - a. Where base metal is specified to be different, provide finish that is an appearance equivalent according to BHMA A156.18.
 - b. Hinges for Fire-Rated Doors: Steel base metal with painted finish.
 - c. Door Closer Covers and Arms: Color to be selected by Architect from manufacturer's standard colors.
 - d. Aluminum Surface Trim and Gasket Housings: To match door, not to match other hardware.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. 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 the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. 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 of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.03 INSTALLATION

- A. Mounting Heights: 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. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
 - 3. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.
- C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule, but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches .
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Permanent cores by Owner.
- F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
 - 1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.
- G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- H. 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 will impede traffic.
- I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.
- J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 FIELD QUALITY CONTROL

- A. Hardware supplier to perform final inspection of installed hardware. Supplier shall provide report identifying whether work does or does not comply with requirements, indicating if non-compliance is a result of improper installation, operational or required adjustments.

3.05 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. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
 2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
 3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 4. Gasketing: Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.
- B. Replace units that cannot be adjusted to operate as intended.

3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.07 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.08 DOOR HARDWARE SCHEDULE

- A. Door hardware schedule is located on Drawings.

END OF SECTION

SECTION 088000 - GLAZING**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. Glass for windows, doors, interior borrowed lites, storefront framing and glazed curtain walls.
 - 2. Glazing sealants and accessories.
- B. Related Requirements:
 - 1. Section 088300 "Mirrors."

1.03 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.04 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product, provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- B. Glass Samples: For each type of the following products; 12 inches square.
 - 1. Tinted glass.
 - 2. Coated glass.
 - 3. Laminated glass.
 - 4. Insulating glass.
- C. Glazing Accessory Samples: For sealants, tapes, gaskets and colored spacers, in 12-inch lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, manufacturers of insulating-glass units with sputter-coated, low-E coatings.
- B. Product Certificates: For glass.
- C. Product Test Reports: For coated glass, insulating glass, and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties, including project specific requirements and warranty period.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Fabricator Qualifications: Company or companies specializing in performing the work of this section with minimum 5 years documented experience in design, detailing, fabrication and installation of products specified in this section.
- C. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- E. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.08 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:
1. Guardian Industries Corp.
 2. Oldcastle BuildingEnvelope.
 3. Pilkington North America Inc.
 4. Saint-Gobain Corporation.
 5. Schott North America, Inc.
 6. Viracon, Inc.
 7. Vitro Architectural Glass.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
1. Obtain reflective-coated glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.02 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
1. Design Wind Pressures: As indicated on Drawings.
 2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6 mm thick, unless otherwise indicated.
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.

5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.03 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Temporary Labeling: Provide temporary label on each light of glass identifying manufacturer or brand, and glass type, quality and nominal thickness. Temporary labels shall remain intact until glass installation is approved.
 1. Low-E Coatings: Provide temporary label indicating location of low-e coatings on insulated units to ensure units are installed in proper orientation, with low-e coating on specified surface.
- E. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- F. Strength: Where annealed float glass is indicated, provide heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.04 GLASS PRODUCTS

- A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated. The deviation from flatness at any peak (peak to valley deviation) shall not exceed 0.003 inches in the center of the lite and shall not exceed 0.008 inches within 10.5 inches of the leading or trailing edge.
- B. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated. The deviation from flatness at any peak (peak to valley deviation) shall not exceed 0.003 inches in the center of the lite and shall not exceed 0.008 inches within 10.5 inches of the leading or trailing edge.

2.05 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

2. Spacer: Polypropylene-covered stainless steel [Polypropylene-covered stainless steel warm edge spacer.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide the following or equal, as acceptable to Architect.
 - 1) Technoform; TGI-Spacer M with Wire, Warm Edge Spacer.
 - b. Color: Match frame color, as acceptable to Architect.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.06 GLAZING SEALANTS

- A. General:
 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 791 or 795.

2.07 GLAZING TAPES

- A. General: Do not use tape materials containing EPDM in conjunction with gray structural silicone sealant.
- B. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- C. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.08 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
 1. Do not use EPDM based materials in conjunction with gray structural silicone sealant.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.09 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.
- D. For dual-sealed structurally glazed insulated glazing units, the primary seal shall not extend past the top edge of the spacer, and shall not be visible above the spacer sightline depth.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
 - 5. Inspect perimeter of insulated glazing units for edge damage. Use of edge damaged insulated glazing units is not allowed. Remove and replace damaged glazing units.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.03 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.04 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.06 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.07 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.08 INSULATING GLASS SCHEDULE

- A. Glass Type - Vision Glazing: Low-E-coated, clear insulating laminated glass.
 - 1. Basis-of-Design Product: Vitro Architectural Glass; 6 mm Solarban 70 (2) | Air 1/2" | 6 mm Clear
 - 2. Overall Unit Thickness: 1 inch.
 - 3. Minimum Thickness of Outdoor Lite: 6 mm.
 - 4. Outdoor Lite: Heat-strengthened float glass.
 - 5. Interspace Content: Air.
 - 6. Indoor Lite: Heat-strengthened float glass.
 - 7. Low-E Coating: Sputtered on second surface.
 - 8. Winter Nighttime U-Factor: 0.28 maximum.
 - 9. Summer Daytime U-Factor: 0.26 maximum.
 - 10. Visible Light Transmittance: 63 percent minimum.
 - 11. Solar Heat Gain Coefficient: 0.27 maximum.
 - 12. Visible Light Reflectance: 13 percent maximum.
 - 13. Ultraviolet Transmittance: 0 percent
 - 14. Safety glazing required.

END OF SECTION

SECTION 088300 - MIRRORS

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 the following types of silvered flat glass mirrors:
 - 1. Annealed monolithic glass mirrors.
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glass with reflective coatings used for vision and spandrel lites.
 - 2. Section 102800 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
 - 2. Mirror mastic.
 - 3. Mirror hardware.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.
- C. Samples: For each type of the following:
 - 1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
 - 2. Mirror Trim: 12 inches long.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of mirror and mirror mastic.
- C. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.
- D. Sample Warranty: For special warranty, including project specific requirements and warranty period.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For mirrors to include in maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.07 PRECONSTRUCTION TESTING

- A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.
 - 1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.09 FIELD CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Avalon Glass and Mirror Company.
 - 2. D & W Incorporated.
 - 3. Gardner Glass Products, Inc.
 - 4. Glasswerks LA, Inc.
 - 5. Guardian Industries Corp.
 - 6. Lenoir Mirror Company.
 - 7. National Glass Industries.
 - 8. Trulite Glass & Aluminum Solutions.
 - 9. Virginia Mirror Company, Inc.
 - 10. Walker Glass Co., Ltd.
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.02 SILVERED FLAT GLASS MIRRORS

- A. Mirrors, General: ASTM C 1503.
- B. Annealed Monolithic Glass Mirrors: Mirror Select Quality, clear.
 - 1. Nominal Thickness: 6.0 mm.
- C. Safety Glazing Products: For film-backed mirrors, provide products that comply with 16 CFR 1201, Category II.

2.03 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

- C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

2.04 MIRROR HARDWARE

- A. Mirror Bottom Clips: As indicated.
- B. Mirror Top Clips: As indicated.
- C. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.
 - 1. Profile: As indicated.
 - 2. Finish: Brushed.
- D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- E. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.05 FABRICATION

- A. Fabricate mirrors in the shop to greatest extent possible.
- B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- C. Mirror Edge Treatment: Rounded polished.
 - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
 - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
- B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.
- C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.03 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
 - 1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."
- B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
 - 1. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced.

2. Install mastic as follows:
 - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
 - b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.04 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer.

END OF SECTION

SECTION 089119 - FIXED LOUVERS**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. Fixed, extruded-aluminum louvers.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Frames" for louvers in hollow-metal doors.
 - 2. Section 081416 "Flush Wood Doors" for louvers in flush wood doors.

1.03 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
 - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
 - 2. Show mullion profiles and locations.
- C. Samples for Initial Selection: For each finish product specified, complete sets of color chips representing manufacturer's full range of available finishes, colors, and textures.
- D. Samples for Verification: Submit samples 2 by 2 inches in size illustrating each type finish and color of exterior surfaces.
- E. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Product Evaluations: Provide copy of current Product Evaluation acceptable to authorities having jurisdiction as proof of compliance that fixed louvers have been tested and accepted for use at the wind load and design pressure level requirements specified for the Project.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing louvers with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this Section with documented experience in detailing and installation of products specified in this Section.

1.07 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.08 WARRANTY

- A. 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 D 2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
- C. Hurricane Resistance: Provide fixed louvers as complete and tested system, to meet the specified wind loads and design pressures, as detailed in the current code sections applicable to the Project; with Product Evaluations acceptable to authorities having jurisdiction.
- D. Windborne-Debris-Impact Resistance: Louvers located within 30 feet of grade shall pass basic -protection, large-missile testing requirements in ASTM E 1996 for Wind Zone 2 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than louvers indicated for use on Project.
- E. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- G. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.03 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Horizontal, Hurricane Impact, and Wind-Driven-Rain-Resistant Louver:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. OMI Architectural Metal Solutions
 - b. Airolite Company, LLC (The).
 - c. Construction Specialties, Inc.
 - d. Greenheck Fan Corporation.
 - e. Industrial Louvers, Inc.
 - f. Ruskin Company; Tomkins PLC.
 - 2. Louver Depth: As indicated on Drawings.
 - 3. Frame and Blade Nominal Thickness: Not less than 0.081 inch.
 - 4. Louver Performance Ratings:
 - a. Free Area: As indicated on Drawings.
 - b. Air Performance: As indicated on Drawings.
 - c. Wind Driven Rain Resistance: Louvers shall provide wind-driven rain resistant performance when tested in compliance with AMCA 500-L.
 - 5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.04 LOUVER SCREENS

- A. General: Provide screens at each exterior louver as follows, unless otherwise indicated.
 - 1. Screen Location for Fixed Louvers: Interior face.
 - 2. Screening Type: Provide insect screens at intake louvers and bird screens at exhaust louvers.
- B. Secure screen frames to louver frames with machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
 - 1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
 - 2. Finish: Same finish as louver frames to which louver screens are attached.
 - 3. Type:
 - a. Insect Screen: Rewirable frames with a driven spline or insert.
 - b. Bird Screen: Non-rewirable, U-shaped frames.
- D. Louver Screening for Aluminum Louvers:
 - 1. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inchwire.
 - 2. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inchwire.

2.05 BLANK-OFF PANELS

- A. General: Provide inactive areas of each exterior louver with blank-off panels, unless otherwise indicated.
- B. Insulated, Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
 - 1. Thickness: 1 inch.
 - 2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
 - 3. Insulating Core: Rigid, glass-fiber-board insulation.
 - 4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard extruded-aluminum-channel frames, not less than 0.080-inchnominal thickness, with corners mitered and with same finish as panels.
 - 5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
 - 6. Panel Finish: Same finish applied to louvers.
 - 7. Attach blank-off panels with clips.

2.06 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
 - 1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
 - 2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
 - 3. For color-finished louvers, use fasteners with heads that match color of louvers.
- C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- D. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location meeting requirements of Section 076200 "Sheet Metal Flashing and Trim."
- E. Perimeter Sealant: As specified in Section 079200 "Joint Sealants."
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.07 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
 - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern, unless horizontal mullions are indicated.
- C. Maintain equal louver blade spacing to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.
- G. Provide subsills made of same material as louvers or extended sills for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.08 ALUMINUM FINISHES

- A. General: Finishes shall be in compliance with NAAMM - Metal Finishes Manual for Architectural and Metal Products. Finish louvers after assembly.
- B. High-Performance Organic Finish - Two-Coat Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: White or gray, as selected by Architect from standard range of manufacturer, to match adjacent materials.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates and openings, 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. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.03 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.
- G. Blank-Off Panels: Provide inactive areas of each exterior louvers with blank-off panels, unless otherwise indicated.

3.04 ADJUSTING AND CLEANING

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
 - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION

SECTION 092216 - NON-STRUCTURAL METAL FRAMING**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. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.
 - 3. Grid suspension systems for gypsum board ceilings.
- B. Related Requirements:
 - 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."
 - 2. Firestop Tracks and Firestop Track Seals: For each type product.
 - 3. Smoke and Acoustic Track Seals: For each type product.
- B. Partition Type Schedule: Provide a partition type schedule indicating materials to be provided as part of each assembly, as well as fire test numbers and acoustical test numbers showing assembly compliance with fire ratings and acoustical ratings required for the Work. Use same partition type designations indicated on Drawings.
- C. Delegated-Design Submittal: When non-structural metal framing is used in non-standard partition designs or to frame openings over 4 feet in width or special partition details, submit structural calculations prepared, signed, and sealed by a Structural Engineer Licensed in the jurisdiction for the Work substantiating the Contractor's design.

1.04 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For embossed steel studs and runners, firestop track seals, and firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- 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 E 119 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 E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Horizontal Deflection - Typical: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading as follows:
 - 1. Typical: 5 lbf/sq. ft.

2. Assemblies Exposed to Exterior Wind Loads: Wind loads as indicated on Structural Drawings.
- D. Horizontal Deflection - Rigid Applied Surface Materials: For wall assemblies with rigid applied surface materials, limited to 1/360 of the wall height based on horizontal loading as follows:
 1. Typical: 5 lbf/sq. ft.
 2. Assemblies Exposed to Exterior Wind Loads: Wind loads as indicated on Structural Drawings.
- E. Ceiling Deflection: For ceiling assemblies, limited to 1/240 of the span based on loading of 5 lbf/sq. ft.
 1. Ceilings Exposed to Exterior Wind Loads: Meet deflection requirements specified above, but based on wind loads as indicated on Structural Drawings.
- F. Ceiling Deflection - Rigid Applied Surface Materials: For ceiling assemblies with rigid applied surface materials, limited to 1/360 of the span based on loading of 5 lbf/sq. ft. .

2.02 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 2. Protective Coating: ASTM A 653/A 653M, G40 , hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
 1. Steel Studs and Runners:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich Building Systems.
 - 3) MarinoWARE.
 - 4) MBA Building Supplies.
 - 5) MRI Steel Framing, LLC.
 - 6) Phillips Manufacturing Co.
 - 7) Steel Network, Inc. (The).
 - 8) Telling Industries.
 - b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection but at minimum 0.0179 inch .
 - c. Depth: As indicated on Drawings.
 2. Embossed Steel Studs and Runners:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich Building Systems.
 - 3) MarinoWARE.
 - 4) MBA Building Supplies.
 - 5) Phillips Manufacturing Co.
 - 6) Steel Network, Inc. (The).
 - 7) Telling Industries.
 - b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection but at minimum 0.0147 inch .
 - c. Depth: As indicated on Drawings.

- C. Slip-Type Head Joints: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing vertical movement.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.; Deflex Clips.
 - 2) ClarkDietrich Building Systems; FTC3or FTC5.
 - 3) Fire Trak Corp; PosiKlipor RediKlip.
 - 4) Steel Network, Inc. (The); VertiClip SLD Series.
 2. Single Long-Leg Runner System: ASTM C 645 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 of the top of studs to provide lateral bracing.
 3. Double-Runner System: ASTM C 645 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.
 4. 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:
 - 1) BlazeFrame Industries; Bare Slotted Track (BST/BST 2).
 - 2) CEMCO; California Expanded Metal Products Co.; SLP-TRK Slotted Deflection Track.
 - 3) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
 - 4) MBA Building Supplies; FlatSteel Deflection Trackor Slotted Deflecto Track.
 - 5) Metal-Lite; The System.
 - 6) Steel Network, Inc. (The); VertiTrack VTD.
 - 7) Telling Industries; Vertical Slip Trackor Vertical Slip Track II.
- D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of 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:
 - a. BlazeFrame Industries; Intumescent Framing, Fire Stop System.
 - b. Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
- E. Firestop Top Track Seal: One-piece, pre-formed, polyurethane foam based, firestop seal as specified in Section 078400 "Firestopping," for use with standard head-joint top tracks and bottom-joint tracks, and slip-type head joints in fire-rated construction at top or bottom of partition to maintain continuity of the fire-resistance-rated assembly indicated.
- F. Smoke and Acoustic Track Seal: One-piece, pre-formed, polyurethane foam based, smoke and acoustic seal for use with standard head-joint top tracks and bottom-joint tracks, and slip-type head joints in non-fire-rated construction at top or bottom of partition. Provide in width and configuration required to accommodate depth and installation of studs and designed to saddle-over the top track or under the bottom-track.
1. Products: Subject to compliance with requirements, provide the following:
 - a. Hilti, Inc.; CS-TTS SA Smoke and Acoustic Total Track Seal.
 2. Performance Requirements:
 - a. Movement: +/- 50 percent.
 - b. Surface Burning Characteristics (U.L. 723) ASTM E84: Flame Spread: 5; Smoke Development: 40.
 - c. Mold-Mildew Performance (ASTM G21-96): Class 0.
 - d. VOC Content: 0.20 lb./gallon maximum.
- G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0329 inch .
- H. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
 1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches , 0.068-inch- thick, galvanized steel.
- I. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 1. Minimum Base-Metal Thickness: 0.0179 inch .
 2. Depth: As indicated on Drawings.
- J. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
 1. Configuration: Asymmetrical or hat shaped.
- K. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
 1. Depth: As indicated on Drawings.
 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch .
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- L. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches , wall attachment flange of 7/8 inch , minimum uncoated-metal thickness of 0.0179 inch , and depth required to fit insulation thickness indicated.

2.03 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Hanger Attachments to Concrete:
 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.
 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
 1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 2. Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0179 inch .
 - b. Depth: As indicated on Drawings.
 3. Embossed Steel Studs and Runners: ASTM C 645.
 - a. Minimum Base-Metal Thickness: 0.0147 inch .
 - b. Depth: As indicated on Drawings.
 4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: 0.0179 inch .

5. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, 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:
 - a. Armstrong World Industries, Inc; Drywall Grid Systems.
 - b. Chicago Metallic Corporation; .
 - c. United State Gypsum Company; Drywall Suspension System.

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 the following:
 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch 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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

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.
- B. Coordination with Sprayed Fire-Resistive Materials:
 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: As required by horizontal deflection performance requirements, but at maximum 16 inches o.c.
 - 2. Multilayer Application: As required by horizontal deflection performance requirements, but at maximum 16 inches o.c.
 - 3. Tile Backing Panels: As required by horizontal deflection performance requirements, but at maximum 16 inches o.c.
 - 4. Specialty Finishes: As required by finish manufacturer and by horizontal deflection performance requirements.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. 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 that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems 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 1/2-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.
 - b. Firestop Track Seals: Install to maintain continuity of fire-resistance-rated assembly indicated. Install in accordance with the firestop manufacturer's printed installation instructions.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - a. Smoke and Acoustic Track Seal: Install to comply with smoke and acoustic device manufacturer's written installation instructions for products and applications indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

- E. Direct Furring:
 - 1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Shaped Furring Members:
 - 1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Supplemental Framing and Blocking: Install supplementary framing in Assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by framing.
 - 1. Blocking: Install fire treated wood blocking or mechanically fastened sheet metal blocking for support of:
 - a. Framed openings.
 - b. Wall mounted cabinets.
 - c. Plumbing fixtures.
 - d. Toilet partitions.
 - e. Grab bars.
 - f. Toilet accessories.
 - g. Wall mounted door hardware and accessories.
 - h. Audiovisual equipment.
 - 2. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
 - 3. Handrail/Grab Bar Reinforcing: Where handrails and grab bars directly attach to gypsum board assemblies, provide galvanized steel reinforcing strip with 0.0312 inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 gypsum board face-layer panel.
- H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.05 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches o.c.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
 - 3. Furring Channels (Furring Members): 16 inches o.c.
- 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 from contact 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, countersplaying, 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 that 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. 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.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 092900 - GYPSUM BOARD**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. Interior gypsum board.
 - 2. Exterior gypsum board for ceilings and soffits.
 - 3. Tile backing panels.
- B. Related Requirements:
 - 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
 - 2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Ceiling system members.
 - 2. Method of attaching hangers to building structure.
 - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- C. Samples for Initial Selection: For each type of trim accessory indicated.
- D. Samples for Verification: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
- E. Partition Type Schedule: For gypsum board assemblies, provide a partition type schedule indicating materials to be provided as part of each assembly, as well as fire test numbers and acoustical test numbers showing assembly compliance with fire ratings and acoustical ratings required for the Work. Use same partition type designations indicated on Drawings.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing gypsum board application and finishing and with documented experience in detailing and installation of gypsum board assemblies.
- B. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.06 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 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 E 90 and classified according to ASTM E 413 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.
- B. Product Qualifications: Provide each type gypsum board product from a single manufacturer.

2.03 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Typical - GB-1B: ASTM C1396/C 1396M.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; Sheetrock Brand Firecode X Gypsum Panels or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 - d. USG.
 - 2. Thickness: 5/8 inch, Type X.
 - 3. Long Edges: Tapered.
- B. Flexible Gypsum Board - GB-1D: ASTM C1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; Sheetrock 1/4" Flexible Gypsum Panels or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 - d. USG.
 - 2. Thickness: 1/4 inch.
 - 3. Long Edges: Tapered.

- C. Impact-Resistant, Mold-Resistant Gypsum Board - GB-1G: ASTM C1396/C 1396M gypsum board, tested according to ASTM C 1629/C 1629M; with moisture- and mold-resistant core and paper surfaces.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 - d. USG.
 2. Core: 5/8 inch, Type X.
 3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements.
 4. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
 5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
 6. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements according to test in Annex A1.
 7. Long Edges: Tapered.
 8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- D. Mold-Resistant Gypsum Board - GB-1C: ASTM C1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; Sheetrock Brand Mold Tough Firecode Core Gypsum Panels or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 - d. USG.
 2. Core: 5/8 inch, Type X.
 3. Long Edges: Tapered.
 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.04 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C - GB-1H and GB-1J: ASTM C1396/C 1396M. Type C, manufactured to have increased fire-resistive capability.
1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation; Firecode C Core or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 - d. United States Gypsum Company.
 2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 3. Long Edges: Tapered.

2.05 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Glass-Mat Gypsum Sheathing Board - GB-2B: ASTM C1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation, Securock Glass-Mat Sheathing Panels or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - c. National Gypsum Company.
 - d. United States Gypsum Company.
 2. Core: 5/8 inch, Type X.

2.06 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board - GB-3A: ASTM C1178/C 1178M, with manufacturer's standard edges.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation, Securock Glass-Mat Sheathing Panels or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Building Products.
 - 2. Core: 5/8 inch, Type X.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Gypsum Fiber Backer Units - GB-3C: ASTM C 1278, gypsum and cellulose core backing panel, fiber reinforced with paperless faces and manufacturer's standard edges.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. USG Corporation; Fiberock Aqua-Tough Interior Panel.
 - 2. Core: 5/8 inch, Type X.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- C. Cementitious Backer Units - GB-3B: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide USG Corporation, Durock Brand Cement Board or comparable product by one of the following:
 - a. CertainTeed Corporation.
 - b. Custom Building Products.
 - c. James Hardie Building Products, Inc.
 - d. National Gypsum Company.
 - e. United States Gypsum Company.
 - 2. Thickness: 5/8 inch .
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.07 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Paper-faced galvanized-steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Deflection bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - e. Expansion (control) joint.
 - f. Curved-Edge Cornerbead: With notched or flexible flanges.
 - g. Tear Away Edge Bead: Provide at ends of gypsum board that abuts window frames. Bead shall be fabricated of rigid PVC conforming to ASTM D 1784, D3678, Class II and C 1047. Tear away bead shall have a full 5/16 inch tear-off leg which acts as a guide for taping knife as well as protective masking for mudding and painting. When finished the leg shall be torn off.
 - 1) Basis-of-Design Product: Subject to compliance with requirements, provide Trim-Tex "Tear Away 'L' Bead", or comparable product as acceptable to Architect.
 - h. Fire Rated Deflection Bead: Fire rated wall mount deflection bead for both static and dynamic head of wall joints, meeting requirements of UL 2079 and Section 078400 "Firestopping," and sound tested according to ASTM E 90. Fabricated of PVC with intumescent firestopping tape.
 - 1) Basis-of-Design Product: Subject to compliance with requirements, provide Trim-Tex "Fire Bead", or comparable product as acceptable to Architect
 - 2) Hourly Rating: As required to meet hourly rating of associated wall assembly.

- B. Exterior Trim: ASTM C1047.
 - 1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.
- C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corporation.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 , Alloy 6063-T5.
 - 3. Finish: As selected by Architect from full range of manufacturer.

2.08 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Exterior Gypsum Soffit Board: Paper.
 - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
 - 4. 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 and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
 - a. Basis-of-Design Product - High Build Coating Product: Subject to compliance with requirements, provide USG Corporation; Tuff-Hide Sheetrock Brand Primer-Surfacer, or comparable product as acceptable to Architect.
- D. Joint Compound for Exterior Applications:
 - 1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.
- E. Joint Compound for Tile Backing Panels:
 - 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.
 - 3. Gypsum Fiber Backer Units: As recommended by backer unit manufacturer.

2.09 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; RCS20 Acoustical.
 - b. Hilti, Inc.; CP506 Smoke and Acoustic Sealant.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Tremco, Incorporated; Tremco Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-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.

- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Sound Attenuation Blankets: Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.
 - 1. Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- K. Acoustical Sealant: Install in accordance with manufacturer's instructions, meeting requirements of Section 079219 "Acoustical Joint Sealants," and as follows:
 - 1. Place one bead continuously on substrate before installation of perimeter framing members.
 - 2. Place continuous bead at perimeter of each layer of gypsum board.
 - 3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.
 - 4. For rated construction meet requirements of Section 078400 "Firestopping."

3.03 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) for metal stud framed construction and horizontally (perpendicular to framing) for wood framed construction, unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- B. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 - 3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 - 4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners], unless separate fastening of both base and face layers with screws is required by fire-resistance rated assembly.

- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- D. Curved Surfaces:
 - 1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
 - 2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.04 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - 1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
 - 2. Fasten with corrosion-resistant screws.

3.05 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Gypsum Fiber Backer Units: Comply with manufacturer's written installation instructions.
- C. Cementitious Backer Units: ANSI A108.11.
- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.06 INSTALLING TRIM ACCESSORIES

- A. General: 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.
- B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
 - 2. LC-Bead: Use at exposed panel edges.
 - 3. U-Bead: Use at exposed panel edges.
 - 4. Curved-Edge Cornerbead: Use at curved openings.
 - 5. Tear Away Edge Bead: Use at ends of gypsum board that abut window frames.
 - 6. Deflection Bead: Exposed panel edges at head of wall conditions.
 - 7. Fire Rated Deflection Bead: Panel edges at fire-rated head of wall conditions.
- D. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
- E. Aluminum Trim: Install in locations indicated on Drawings.

3.07 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, attics, concealed areas, and where indicated.
 - a. Joints and interior angles shall have tape embedded in joint compound. Surfaces shall be free of excess joint compound. Tool marks and ridges are acceptable.
2. Level 2: Panels that are substrate for tile, utility areas, and behind cabinetry.
 - a. Joints and interior angles shall have tape embedded in joint compound and one separate coat of joint compound applied over joints, angles, fastener heads, and accessories. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
 - a. Joints and interior angles shall have tape embedded in joint compound and 3 separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Joint compound shall be smooth and free of tool marks and ridges. Prepare surface to be coated with a primer/sealer prior to the application of final finishes.
 - b. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
4. Level 5: Where semigloss and gloss paints are indicated, where severe lighting conditions occur, behind wall covering, behind specialty wall graphics, and at locations with critical light.
 - a. Joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over joints, angles, fastener heads, and accessories. Joint compound shall be smooth and free of tool marks and ridges. Prepare surface to be coated with a primer/sealer prior to the application of finish paint by applied monolithic coat of joint compound over entire surface.
 - b. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 - c. Use of specified high build drywall surfacer to achieve Level 5 finish is acceptable.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.
- H. Level 5 Finish High Build Drywall Surfer: Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated to minimum Level 4 Finish meeting instructions and recommendations of manufacturer; achieve a flat and tool mark-free finish as acceptable to Architect.

3.08 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.09 GYPSUM BOARD SCHEDULE

- A. General: When Drawings do not indicate a specific type of board, provide type products for specific locations as specified in this Article.
- B. Fire Rated Assemblies: Provide as follows:
 1. Gypsum Board, Type X: Provide gypsum board, Type X on all partitions and ceiling assemblies requiring a fire rating, unless Type C is required for rated assemblies.
 2. Gypsum Board, Type C: As require for fire rated assemblies.

- C. Board Material - Exterior Locations:
 - 1. Protected Ceilings and Soffits to Receive Cladding Material: GB-2B, glass-mat gypsum sheathing board.
- D. Board Material - Interior Locations:
 - 1. Walls - Typical: GB-1B, gypsum board, 5/8 inch thick.
 - 2. Ceilings - Typical: GB-1B, gypsum board, 5/8 inch thick.
 - 3. Walls and Ceilings in Wet and High Humidity Spaces: Toilet rooms, trash rooms, loading areas, janitorial closets and like spaces: GB-1C, mold-resistant gypsum board, 5/8 inch thick.
 - 4. Curved Surfaces: GB-1D, flexible gypsum board, 1/4 inch thick, unless otherwise required for rated assemblies.
 - 5. Areas Subject to Abuse: Maintenance areas, repair shop areas, and like spaces: GB-1G, impact-resistant gypsum board, 5/8 inch thick.
 - 6. Areas To Receive Tile: GB-3B, cementitious backer unit, 5/8 inch thick;.

END OF SECTION

SECTION 095113 - ACOUSTICAL PANEL CEILINGS**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. Acoustical panels and exposed suspension systems for interior ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product, including acoustical units, suspension system, and accessories.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Samples for Initial Selection: For components with factory-applied finishes.
- D. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
 - 1. Acoustical Panels: Set of 6-inch- square samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.05 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling suspension-system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
 - 4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
 - 5. Size and location of initial access modules for acoustical panels.
 - 6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.
 - e. Sprinklers.
 - f. Access panels.
 - g. Perimeter moldings.
 - 7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
 - 8. Minimum Drawing Scale: 1/4 inch = 1 foot .
- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

- C. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.06 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

1.07 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.08 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum 5 years documented experience.
- B. Installer Qualifications: Company specializing in installation of the products and systems specified in this Section with minimum 3 years documented experience.

1.09 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.11 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.

2.03 ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products specified or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. United States Gypsum Company.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.
- D. Acoustical Panels Type ACP-1: Membrane-faced mineral fiber; ASTM E1264 Type IV, Form 2; with the following characteristics:
 - 1. Basis-of-Design Product: Armstrong World Industries, Inc.; Ultima Tegular.
 - 2. Modular Size: 24 by 24 inches.
 - 3. Thickness: 3/4 inch.
 - 4. Light Reflectance: Not less than 0.90, determined as specified in ASTM E1264.
 - 5. NRC Range: Not less than 0.70, determined as specified in ASTM E1264.
 - 6. Ceiling Attenuation Class (CAC): Not less than 35, determined as specified in ASTM E1264.
 - 7. Edge: 15/16 inch, beveled tegular.
 - 8. Surface Color: White.
 - 9. Surface Pattern: Pattern E (lightly textured).

2.04 METAL SUSPENSION SYSTEM

- A. Manufacturers: Acoustical panel manufacturer.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System SS-1: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
 - 1. Basis-of-Design Product: Armstrong World Industries, Inc.; Prelude XL 15/16".
 - 2. Structural Classification: Heavy-duty system.
 - 3. Face Design: Flat, flush.
 - 4. Cap Material: Cold-rolled steel.
 - 5. Cap Finish: Painted white.

2.05 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, 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/E 488M or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Type: Postinstalled expansion or anchors.
 - b. Corrosion Protection - Typical: Carbon-steel components zinc plated according to ASTM B 633, Class SC 1 (mild) service condition.

2. Power-Actuated Fasteners in Concrete: Fastener 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.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
1. Zinc-Coated, Carbon-Steel Wire - Typical: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.
- F. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

2.06 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if 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. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 2. Stepped Edge Molding: 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.
 - a. Basis-of-Design Product: Armstrong World Industries, Inc.; Shadow Molding.
 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly. Formable plastic coated metal type moldings are not acceptable.
- 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. Provide straight or curved assemblies as indicated, and with factory mitered corners.
1. Basis-of-Design Product: Armstrong World Industries, Inc.; Axiom Trim.
 2. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.07 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.03 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 6. Install clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
 7. Lay sound-attenuation blankets for a distance of 48 inches either side of acoustical partitions, and where indicated.

3.04 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.05 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.06 ACOUSTICAL PANEL CEILING SCHEDULE

- A. Acoustical Panel Ceiling ACT-1: 24"x 24" grid pattern with exposed suspension system with 15/16 inch wide flanges, and acoustical panels with beveled tegular edges.
1. Panel: ACP-1.
 2. Suspension System: SS-1.

END OF SECTION 095113

SECTION 099113 - EXTERIOR PAINTING**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 surface preparation and the application of paint systems on exterior substrates, including but not limited to the following:
 - 1. Concrete.
 - 2. Steel and iron.
 - 3. Galvanized metal.
- B. Related Requirements:
 - 1. Division 05 - Metals for shop priming of metal substrates.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.
- B. Coating Maintenance Manual: Upon completion of the Work the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report, or equal as acceptable to Architect. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product, color and finish was used, product data pages, Material Safety Data Sheets (MSDS), care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- C. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.
- B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 COORDINATION

- A. Coordinate topcoats with primer selections for shop primed fabrications. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another. Provide intermediate coats as required to ensure compatibility between coats.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in Article "Exterior Painting Schedule" of this Section for the paint category indicated, or comparable product by one of the following:
 1. Benjamin Moore & Co.
 2. PPG Architectural Finishes, Inc.
 3. Sherwin-Williams Company (The).

2.02 PAINT, GENERAL

- A. Scope: Finish all exterior surfaces exposed to view, unless fully factory-finished or indicated to remain unfinished. Do not paint or finish the following items:
 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 2. Items indicated to receive other finishes.
 3. Items indicated to remain unfinished.
 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 5. Non-metallic roofing and flashing.
 6. Stainless steel, anodized aluminum, bronze, terne, and lead items.
 7. Marble, granite, slate, and other natural stones.
 8. Floors, unless specifically so indicated.
 9. Ceramic and other tiles.

10. Integrally colored portland cement plaster (stucco), not indicated to be painted.
 11. Glass.
 12. Acoustical materials, unless specifically so indicated.
 13. Concealed pipes, ducts, and conduits.
- B. Manufacturers:
1. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- C. Provide all paint and coating products from the same manufacturer to the greatest extent possible.
- D. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- E. Primers: Provide primers that are compatible with finish coats used. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- F. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction .
- G. Colors and Gloss: As indicated on drawings. Colors and gloss not indicated on drawings will be selected later by Architect from the manufacturer's full line.

2.03 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacture but not less than the following:
 1. SSPC-SP 2.
- F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.03 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 1. Use applicators and techniques suited for paint and substrate indicated.
 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
 4. Paint entire exposed surface of window frames and sashes.
 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 1. Paint the following work where exposed to view:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.

3.04 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 EXTERIOR PAINTING SCHEDULE

- A. Concrete Substrates:
 1. Concrete Substrates, Miscellaneous Nontraffic Surfaces:
 - a. High Build Acrylic System:
 - 1) Primer: Alkali resistant, water based, as recommended by top coat manufacturer.
 - 2) Two Top Coats: Exterior high build acrylic, dry film thickness of not less than 10 mils.
 - a) Benjamin Moore & Co.; Ultra Spec Masonry Acrylic Latex.
 - b) PPG Paints; Perma-Crete High Build 100% Acrylic Topcoat.
 - c) Sherwin-Williams Company (The); Loxon XP High Build Acrylic.
- B. Exposed Structural Steel: High Performance Polyurethane Coating System specified in Section 099600 "High-Performance Coatings."
- C. Steel and Iron Substrates:
 1. Light Industrial Acrylic System:
 - a. Primer: For shop primed surfaces, touch-up with rust-inhibitive primer recommended by top coat manufacturer. For unprimed surfaces, primer shall be anticorrosive primer as recommended by top coat manufacturer for exterior use on ferrous metals.
 - b. Two Top Coats: Exterior light industrial acrylic.
 - 1) Benjamin Moore & Co.; Ultra Spec EXT.
 - 2) PPG Paints; Pitt-Tech Plus Waterborne Acrylic.
 - 3) Sherwin-Williams Company (The); Pro Industrial Acrylic.
- D. Galvanized-Metal Substrates:
 1. Light Industrial Acrylic System:
 - a. Primer: Galvanized metal primer recommended by top coat manufacturer for use on exterior galvanized metal surfaces.
 - b. Two Top Coats: Exterior light industrial acrylic.
 - 1) Benjamin Moore & Co.; Ultra Spec EXT.
 - 2) PPG Paints; Pitt-Tech Plus Waterborne Acrylic.
 - 3) Sherwin-Williams Company (The); Pro Industrial Acrylic.

END OF SECTION

SECTION 099123 - INTERIOR PAINTING**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 surface preparation and the application of paint systems on interior substrates, including but not limited to the following:
 - 1. Concrete.
 - 2. Concrete masonry units (CMUs).
 - 3. Steel and iron.
 - 4. Galvanized metal.
 - 5. Wood.
 - 6. Gypsum board.
- B. Related Requirements:
 - 1. Division 05 - Metals for shop priming structural steel.
 - 2. Section 055000 "Metal Fabrications" for shop priming metal fabrications.
 - 3. Section 099600 "High-Performance Coatings" for tile-like coatings.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.
- B. Coating Maintenance Manual: Upon completion of the Work the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report, or equal as acceptable to Architect. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product, color and finish was used, product data pages, Material Safety Data Sheets (MSDS), care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- C. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

- B. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.07 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in Article "Interior Painting Schedule" of this Section for the paint category indicated, or comparable product by one of the following:
1. Benjamin Moore & Co.
 2. PPG Architectural Finishes, Inc.
 3. Sherwin-Williams Company (The).

2.02 PAINT, GENERAL

- A. Scope: Finish all exterior surfaces exposed to view, unless fully factory-finished or indicated to remain unfinished. Do not paint or finish the following items:
1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 2. Items indicated to receive other finishes.
 3. Items indicated to remain unfinished.
 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 5. Stainless steel, anodized aluminum, bronze, terne, and lead items.
 6. Marble, granite, slate, and other natural stones.
 7. Floors, unless specifically so indicated.
 8. Ceramic and other tiles.
 9. Integrally colored portland cement plaster (stucco), not indicated to be painted.
 10. Glass.
 11. Acoustical materials, unless specifically so indicated.
 12. Concealed pipes, ducts, and conduits.

- B. Manufacturers: Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- C. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- D. Primers: Provide primers that are compatible with finish coats used. Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- E. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction .
- F. Colors and Gloss: As indicated on drawings. Colors and gloss not indicated on drawings will be selected later by Architect from the manufacturer's full line.

2.03 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (Clay and CMUs): 12 percent.
 - 3. Wood: 15 percent.
 - 4. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

- D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2.
- G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- I. Wood Substrates:
 - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
 - 2. Sand surfaces that will be exposed to view, and dust off.
 - 3. Prime edges, ends, faces, undersides, and backsides of wood.
 - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- J. Gypsum Board Substrates:
 - 1. Remove chalk, dust, dirt, and other foreign material that might impair bond of paints to substrates.
 - 2. Spackle minor cracks, voids, blemished and other imperfections in gypsum board surfaces which necessitate only minimum work. Spackle shall be flush with adjoining surfaces and when dry, sand smooth. After prime coat, if any defects become evident or additional spackling is necessary, perform further spackling before following coat of paint is applied.
 - 3. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

3.03 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.04 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.06 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates:
 1. Concrete Substrates, Nontraffic Surfaces - General:
 - a. Acrylic Latex System:
 - 1) Primer: Concrete latex primer, as recommended by top coat manufacturer.
 - 2) Two Top Coats: Acrylic latex enamel.
 - a) Benjamin Moore & Co.; Ultra Spec 500 Interior.
 - b) PPG Paints; Speedhide Zero VOC Interior Latex.
 - c) Sherwin Williams Company (The); ProMar 200 Zero VOC Interior Latex.
 2. Concrete Substrates, Nontraffic Surfaces - Public Toilet Rooms, Janitorial Closets, Mechanical Spaces, Trash Rooms, and Other Like Spaces:

- a. Single-Component Acrylic Epoxy System:
 - 1) Primer: Concrete primer, as recommended by top coat manufacturer.
 - 2) Two Top Coats: Pre-catalyzed, single component acrylic epoxy.
 - a) Benjamin Moore & Co.; COROTECH WB Pre-Catalyzed Waterborne Epoxy.
 - b) PPG Paints; PITT-GLAZE WB1 Interior Pre-Catalyzed Water-Borne Acrylic Epoxy.
 - c) Sherwin-Williams Company (The); Pro-Industrial Pre-Catalyzed Waterbased Epoxy.
 3. Interior Concrete Floor Markings: As specified in Section 099600 "High-Performance Coatings".
- B. CMU Substrates:
1. CMU Substrates - General:
 - a. Acrylic Latex System:
 - 1) Primer: Latex block filler as recommended by top coat manufacturer for interior concrete unit masonry surfaces.
 - 2) Two Top Coats: Acrylic latex enamel.
 - a) Benjamin Moore & Co.; Ultra Spec 500 Interior.
 - b) PPG Paints; Speedhide Zero VOC Interior Latex.
 - c) Sherwin Williams Company (The); ProMar 200 Zero VOC Interior Latex.
 2. CMU Substrates - Public Toilet Rooms, Janitorial Closets, Trash Rooms, Mechanical Spaces, and Other Like Spaces:
 - a. Single-Component Acrylic Epoxy System:
 - 1) Primer: Block filler as recommended by top coat manufacturer for interior concrete unit masonry surfaces.
 - 2) Two Top Coats: Pre-catalyzed, single component acrylic epoxy.
 - a) Benjamin Moore & Co.; COROTECH WB Pre-Catalyzed Waterborne Epoxy.
 - b) PPG Paints; PITT-GLAZE WB1 Interior Pre-Catalyzed Water-Borne Acrylic Epoxy.
 - c) Sherwin-Williams Company (The); Pro-Industrial Pre-Catalyzed Waterbased Epoxy.
- C. Exposed Structural Steel: High Performance Polyurethane Coating System specified in Section 099600 "High-Performance Coatings."
- D. Steel Substrates:
1. Steel Substrates - Metal Fabrications, Railings, Hollow Metal Doors and Frames, and Other Like Items: Provide one of the following:
 - a. Single-Component Acrylic Epoxy System:
 - 1) Primer: For shop primed surfaces, touch-up with rust-inhibitive primer recommended by top coat manufacturer. For unprimed surfaces, primer shall be anticorrosive as recommended by top coat manufacturer for interior use on ferrous metals.
 - 2) Two Top Coats: Pre-catalyzed, single component acrylic epoxy.
 - a) Benjamin Moore & Co.; COROTECH WB Pre-Catalyzed Waterborne Epoxy.
 - b) PPG Paints; PITT-GLAZE WB1 Interior Pre-Catalyzed Water-Borne Acrylic Epoxy.
 - c) Sherwin-Williams Company (The); Pro-Industrial Pre-Catalyzed Waterbased Epoxy.
 2. Overhead Metal Decking (Pre-Primed Steel):
 - a. Acrylic Dry Fall System:
 - 1) Primer: Shop-primed by deck manufacturer.
 - 2) Two Top Coats: Water-based acrylic dry fall.

- a) Benjamin Moore & Co.; Dry Fall Latex.
- b) PPG Paints; Speedhide SuperTech WB Dry Fog.
- c) Sherwin-Williams Company (The); Pro-Industrial WB Acrylic Dryfall.

E. Galvanized-Metal Substrates:

- 1. Ductwork:
 - a. Light Industrial Acrylic Enamel System:
 - 1) Primer: Galvanized metal primer recommended by top coat manufacturer for use on interior galvanized metal surfaces.
 - 2) Two Top Coats: Industrial, water-based acrylic enamel.
 - a) Benjamin Moore & Co.; Ultra Spec HP DTM Acrylic.
 - b) PPG Paints; Pitt-Tech Plus DTM Industrial Enamel 100% Acrylic.
 - c) Sherwin-Williams Company (The); Pro-Industrial High Performance Acrylic.
- 2. Overhead Metal Decking (Galvanized):
 - a. Acrylic Dry Fall System:
 - 1) Two Top Coats: Water-based acrylic dry fall.
 - a) Benjamin Moore & Co.; Dry Fall Latex.
 - b) PPG Paints; Speedhide SuperTech WB Dry Fog.
 - c) Sherwin-Williams Company (The); Pro-Industrial WB Acrylic Dryfall.

F. Wood Substrates:

- 1. Wood Substrates: Wood trim.
 - a. Single-Component Acrylic Epoxy System:
 - 1) Primer: Wood primer, as recommended by top coat manufacturer.
 - 2) Two Top Coats: Pre-catalyzed, single component acrylic epoxy.
 - a) Benjamin Moore & Co.; COROTECH WB Pre-Catalyzed Waterborne Epoxy.
 - b) PPG Paints; PITT-GLAZE WB1 Interior Pre-Catalyzed Water-Borne Acrylic Epoxy.
 - c) Sherwin-Williams Company (The); Pro-Industrial Pre-Catalyzed Waterbased Epoxy.
 - b. Waterbased Alkyd System:
 - 1) Primer: Wood primer, as recommended by top coat manufacturer.
 - 2) Two Top Coats: Waterbased alkyd.
 - a) Benjamin Moore & Co.; ADVANCE Waterborned Interior Alkyd.
 - b) PPG Paints; Speedhide WB Alkyd.
 - c) Sherwin-Williams Company (The); ProMar 200 Interior Waterbased Acrylic-Alkyd.

G. Gypsum Board Substrates:

- 1. Gypsum Board Substrates:
 - a. Acrylic Latex System - Walls:
 - 1) Primer: Latex primer, as recommended by manufacturer.
 - 2) Two Top Coats: Acrylic latex enamel.
 - a) Benjamin Moore & Co.; Ultra Spec 500 Interior.
 - b) PPG Paints; Speedhide Zero VOC Interior Latex.
 - c) Sherwin Williams Company (The); ProMar 200 Zero VOC Interior Latex.
 - b. Acrylic Latex System - Ceilings:
 - 1) Primer: Latex primer, as recommended by manufacturer.
 - 2) Two Top Coats: Acrylic latex enamel.
 - a) Benjamin Moore & Co.; Ultra Spec 500 Interior Flat Finish.
 - b) PPG Paints; Performance Flat Interior Latex.
 - c) Sherwin Williams Company (The); ProMar 400 Zero VOC Interior Latex Flat.
- 2. Gypsum Board Substrates - Public Toilet Rooms, Janitorial Closets, Trash Rooms, Mechanical Spaces, and Other Like Spaces:

- a. Single-Component Acrylic Epoxy System:
 - 1) Primer: As recommended by top coat manufacturer.
 - 2) Two Top Coats: Pre-catalyzed, single component acrylic epoxy.
 - a) Benjamin Moore & Co.; COROTECH WB Pre-Catalyzed Waterborne Epoxy.
 - b) PPG Paints; PITT-GLAZE WB1 Interior Pre-Catalyzed Water-Borne Acrylic Epoxy.
 - c) Sherwin-Williams Company (The); Pro-Industrial Pre-Catalyzed Waterbased Epoxy.

END OF SECTION

SECTION 099600 - HIGH-PERFORMANCE COATINGS**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 surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Concrete, horizontal surfaces.
 - b. Steel.
 - c. Galvanized metal.
- B. Related Requirements:
 - 1. Division 05 "Metals" for shop priming of structural steel with primers specified in this Section.
 - 2. Section 099113 "Exterior Painting" for general field painting.
 - 3. Section 099123 "Interior Painting" for general field painting.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.04 MAINTENANCE MATERIAL SUBMITTALS

- A. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.
- B. Coating Maintenance Manual: Upon completion of the Work the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams "Custodian Project Color and Product Information" report, or equal as acceptable to Architect. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product, color and finish was used, product data pages, Material Safety Data Sheets (MSDS), care and cleaning instructions, touch-up procedures, and color samples of each color and finish used.
- C. Extra Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.05 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience.

- B. Manufacturer Technical Representative: Furnish services of trained technical representative of high performance coating manufacturer to advise on installation of work. Services of representative at a minimum, shall include attendance of preinstallation meetings, examination of substrates prior to installation, witnessing field testing, and inspection of final installation. Representative shall prepare written reports and submit to Contractor, with copy to Owner and Architect.
- C. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Paint finish repair sample demonstrating field surface preparation, blending of paint surfaces, surface texture and color matching.
 - 3. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 COORDINATION

- A. Coordinate topcoats with primer selections for shop primed fabrications. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another. Provide intermediate coats as required to ensure compatibility between coats.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.08 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

1.09 WARRANTY

- A. Manufacturer's Special Warranty - Corrosion: Manufacturer's standard form in which manufacturer agrees to repair or replace high-performance coatings that deteriorate within specified warranty period.
 - 1. Deterioration includes, but is not limited to, the following:
 - a. Corrosion of metal substrates, with corrosion in excess of 1 percent of the surface area being coated as measured in according to ASTM D 610.
 - 2. Warranty Period: 5 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty - Adhesion: Manufacturer's standard form in which manufacturer agrees to repair or replace high-performance coatings that deteriorate within specified warranty period.
1. Deterioration includes but is not limited to, the following:
 - a. Coatings shall not check, crack, blister or delaminate from the substrate.
 2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in High Performance Coating Schedules in this Section, or comparable product by one of the following:
1. International Paint, LLC.
 2. PPG Architectural Finishes, Inc.
 3. Sherwin-Williams Company (The).
 4. Tnemec Company, Inc.

2.02 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 3. Products shall be of same manufacturer for each coat in a coating system.
- B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction.
- C. Colors and Gloss: As indicated on Drawings. Colors and gloss not indicated on drawings will be selected later by Architect from the manufacturer's full line.

2.03 MISCELLANEOUS MATERIALS

- A. Joint Sealants: Compatible with high-performance coating system, such as the following:
1. Urethane, Single-Component, Nonsag: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Pecora Corporation; DynaTrol I-XL General Purpose One Part Polyurethane Sealant.
 - 2) BASF Construction Chemicals-Building Systems, Master Builders Solutions; MasterSeal NP 1.
 - 3) Sika Corporation; Sikaflex - 1a.
 - 4) Tremco Incorporated; Dymonic.
- B. Filler and Surfacing Epoxy: High performance 100 percent solids epoxy filler and surfacer for surfacing and patching steel imperfections or damage. Epoxy shall be compatible with specified high-performance coating system.
1. Basis-of-Design Product: Subject to compliance with requirements provide the following or comparable product recommended by high-performance coating manufacturer:
 - a. Tnemec Company Inc.; Series 215 Surfacing Epoxy.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Fill surface imperfections in steel that are visible from 10 feet away, with surfacing epoxy.
- E. Fill joints and interfaces that lack or have limited paint coverage with joint sealant.
- F. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Clean using methods recommended in writing by coating manufacturer. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- G. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 10/NACE No. 2.
- H. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- I. Zinc Rich Primed Substrates: Surfaces receiving zinc rich primer shall receive SSPC-SP 11 surface preparation, prior to application of primer.
- J. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.03 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.04 FIELD QUALITY CONTROL

- A. Manufacturer's Technical Representative: Require site attendance of qualified technical representative of high performance coating manufacturer during testing and inspections, and as required to satisfy warranty requirements. Representative shall prepare written reports and submit to Contractor, with copy to Owner and Architect.
- B. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

3.05 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. Touch-Up:
 1. General: At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.
 2. Steel Surfaces:
 - a. Clean and prepare surfaces by SSPC-SP 11 "Power Tool Cleaning to Bare Metal" for zinc-rich primed surfaces.
 - b. Blend edges of existing paint to remain into adjacent cleaned steel surfaces; remove all exposed paint edges.
 - c. Profile surface of tightly adhered existing paint coatings and apply tie coat of specified coating assembly primer.

3.06 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Steel Substrates:
 1. Pigmented Polyurethane over Organic Zinc-Rich Primer and High-Build Epoxy System: with a minimum 80 percent zinc dust in the dry film.
 - a. Primer: Primer, zinc-rich, organic; at 2.5 to 3.5 mils dry film thickness.
 - 1) International Paint, LLC.
 - 2) PPG Paints.
 - 3) Sherwin Williams Company.
 - 4) Tnemec Company Inc.; Series 90-97 Tnemec-Zinc.
 - b. Intermediate Coat: Epoxy, high-build, low gloss; at 5.0 to 8.0 mils dry film thickness.

- 1) International Paint, LLC; Intercure 200HS.
 - 2) PPG Paints; Amercoat 385.
 - 3) Sherwin Williams Company, Macropoxy 646.
 - 4) Tnemec Company Inc.; Series N69 High Build Epoxoline II.
 - c. Topcoat: Polyurethane, two-component, pigmented, gloss; at 2.0 to 3.0 mils dry film thickness.
 - 1) International Paint, LLC; Interthane 990HS.
 - 2) PPG Paints; Amercoat 450H.
 - 3) Sherwin Williams Company; Acrolon Ultra.
 - 4) Tnemec Company, Inc.; 1074 Endura-Shield.
- B. Galvanized-Metal Substrates:
1. Pigmented Polyurethane System:
 - a. Primer: Primer, epoxy for metal at 2.0 to 4.0 mils dry film thickness.
 - 1) Benjamin Moore & Co.; COROTECH Epoxy Mastic Coating V160.
 - 2) International Paint, LLC; Interseal 670HS.
 - 3) PPG Paints; Amercoat 385.
 - 4) Sherwin Williams Company; Macropoxy 646.
 - 5) Tnemec Company Inc.; Series N69 High Build Epoxoline II.
 - b. Topcoat: Polyurethane, two-component, pigmented, gloss; at 2.0 to 4.0 mils dry film thickness.
 - 1) Benjamin Moore & Co.; COROTECH Acrylic Urethane V500.
 - 2) International Paint, LLC; Interthane 990HS.
 - 3) PPG Paints; Amercoat 450H.
 - 4) Sherwin Williams Company; Acrolon Ultra.
 - 5) Tnemec Company, Inc.; 1074 Endura-Shield.

3.07 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Concrete Substrates, Horizontal Surfaces - Floor Markings:
1. High-Performance Epoxy: Industrial epoxy concrete floor coating system capable of withstanding pedestrian and vehicular traffic, repeated cleaning, and exposure to water, salts, chemicals, gasoline and oils.
 - a. Primer/First Coat: 100 percent solids polyamine epoxy, self-priming.
 - 1) Tnemec Company Inc.; Series 281 Tneme-Glaze.
 - b. Topcoat: 100 percent solids polyamine epoxy.
 - 1) Tnemec Company Inc.; Series 281 Tneme-Glaze.

END OF SECTION

SECTION 101400 - SIGNAGE**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. Code and life safety signage.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls " for temporary project identification signs and for temporary information and directional signs.
 - 2. Division 22, 23, and 26 Sections for labels, tags, and nameplates for plumbing, HVAC, and electrical systems and equipment.

1.03 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.04 ACTION SUBMITTALS

- A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- B. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on the drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
 - 3. Submit for approval by Owner through Architect prior to fabrication.
- C. Samples - Initial Selection: Where colors are not specified, submit two sets of color selection charts or chips.
- D. Samples - Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
 - 1. Dimensional Characters: Full-size samples of each type of dimensional character (letter, number, and graphic element).
 - 2. Sheet Materials: 8 inches by 10 inches sample of each color and material required.
 - 3. Panel Signs: Not less than 12 inches square.
 - 4. Room-Identification Signs: Full-size Sample.
 - 5. Field-Applied, Vinyl-Character Signs: Full-size Sample of characters on glass.
 - 6. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
 - 7. Exposed Accessories: Full-size Sample of each accessory type.

1.05 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.07 COORDINATION

- A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.
- B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.08 FIELD CONDITIONS

- A. Field Measurements: Verify locations of anchorage devices and electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASI Sign Systems, Inc.
 - 2. Best Sign Systems, Inc.
 - 3. Cosco Industries.
 - 4. Inpro.
 - 5. Mohawk Sign Systems, Inc.
 - 6. Seton Identification Products.
- B. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.03 SIGNAGE APPLICATIONS

- A. General: Contractor to coordinate signage font and color palette with Owner's signage program.

- B. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- C. Code and Life Safety Signage:
 - 1. Provide signage as required by codes and standards of authorities having jurisdiction, including, but not limited to the following:
 - a. Exit signage.
 - b. Emergency evacuation signage.
 - c. Emergency exit door signage.
 - d. Delayed egress door signage.
 - e. Elevator emergency and equipment room signage.
 - f. Floor identification signage.
 - g. Stairwell storage restriction signage.
 - h. Area of refuge signage.
 - i. Two-way communication signage.
 - j. Fire protection equipment signage.
 - k. Fire command room/center signage.
 - l. Fire department connection signage.
 - m. Fire extinguisher and fire cabinet signage (specified in Section 104400).
 - n. Fire door signage.
 - o. Rated barrier signage.
 - p. Signage for locks on egress side of doors.
 - q. Electrical room signage.
 - r. Accessibility directional signage.
 - s. Hazard identification signage.
 - t. Restroom signage.
 - u. "No Smoking " signage.
 - v. Occupant load signage.
 - w. Live load signage.
 - x. Emergency generator signage.
 - y. Refuse/recycling room signage.
 - z. Fuel storage tank signage.
 - aa. Non-potable water signage.
 - bb. Building Information Signage (BIS) per Appendix J of 2015 International Fire Code.
 - 2. Sign Type: As indicated on Drawings.
- D. Interior Signage:
 - 1. Room Identification Signage: Provide a sign for every room, whether it has a door or not, not including corridors, lobbies, and similar open areas.

2.04 SIGN TYPES

- A. Sign Types and Materials:
 - 1. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
- B. Color and Font: Unless otherwise indicated:
 - 1. Character Font: As indicated on Drawings.
 - 2. Character Case: As indicated on Drawings.
 - 3. Background Color: As indicated on Drawings.
 - 4. Character Color: Contrasting color.

2.05 SIGN MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated
- B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- D. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- E. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.
- F. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.06 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
 - 3. Panel Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
 - b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
 - c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.
 - d. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.
- B. Adhesive: As recommended by sign manufacturer.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.07 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 - 4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 5. Internally brace signs for stability and for securing fasteners.
 - 6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
 - 7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing
- B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.
 - 1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.
 - 2. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.

3. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with manufacturer's standard enamel. Apply manufacturer's standard opaque background color coating to back face of acrylic sheet.
 4. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.
- C. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- D. Subsurface-Engraved Graphics: Reverse engrave back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.
- E. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.
- F. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages, as follows:
1. To be determined.
- G. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match Architect's sample color unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Verify that electrical service is correctly sized and located to accommodate signs.
- E. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation shall indicate acceptance of conditions.

3.02 INSTALLATION GENERAL

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.

3.03 INSTALLATION - PANEL SIGNAGE

- A. Mounting Methods:
 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.
 3. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 4. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 6. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach signs to plate using <Insert mounting method> method specified above.
- B. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.04 ADJUSTING, CLEANING AND PROTECTION

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 104413 - FIRE PROTECTION CABINETS

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. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.04 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

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 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- B. Accessibility: Cabinets shall not project more than 4 inches from the wall when located in accessible spaces or paths of travel.

2.02 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - b. Larsens Manufacturing Company.
 - c. Nystrom, Inc.
 - d. Potter Roemer LLC.
 - e. Strike First Corporation of America.
- B. Cabinet Construction: Rated or non-rated as required to meet fire resistance rating of walls where the cabinets are located.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Recessed Cabinet:
 - 1. Locations: Provide recessed cabinets unless otherwise indicated, or unless walls are of insufficient depth for recessed mounting.
 - 2. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
- E. Semirecessed 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. Locations: Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 - a. Semirecessed cabinets shall not project more than 4 inches from the wall when located in accessible spaces or paths of travel.
 - 2. Trim: Returned to wall surface, with backbend depth as required for wall thickness.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
 - 1. Location: Provide where walls are of insufficient depth for recessed and semirecessed cabinet installation.
- G. Cabinet Trim Material: Same material and finish as door.
- H. Door Material: Steel sheet.
- I. Door Style: Vertical duo panel with frame.
- J. Door Glazing: Tempered float glass (clear).
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide manufacturer's standard.
 - 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- L. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Identify fire extinguisher in cabinet with FIRE EXTINGUISHER lettering applied to door. Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Silk screen, engraved or etched as selected by Architect.
- M. Materials:
 - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.
 - 2. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.03 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.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Miter and weld perimeter door frames.

- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.04 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 PREPARATION

- A. Prepare recesses for recessed semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.04 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 104416 - FIRE EXTINGUISHERS

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. Portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.04 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.06 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.07 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10.
 - b. Faulty operation of valves or release levers.
 - 2. 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. Source Limitations: Obtain fire extinguishers through one source from a single manufacturer.

- B. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ansul Incorporated.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - d. Larsens Manufacturing Company.
 - e. Nystrom Building Products.
 - f. Oval Fire Products Corp.
 - g. Potter Roemer LLC.
 - h. Pyro-Chem; Tyco Safety Products.
 - i. Strike First Corporation of America.
 - 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.
- C. Types and Capacity of Fire Extinguishers: As indicated on Drawings.

2.03 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
- 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.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher, unless otherwise required by authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 107316 - METAL CANOPIES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Furnishing and installation of extruded aluminum overhead cantilever supported canopies.

1.03 ACTION SUBMITTALS

- A. Product Data.
- B. Shop Drawings: Provide fabrication and installation details for metal canopies. Submit shop drawings showing plans, elevations, and sections; and details showing dimensioning, member profiles, anchorage system, and interface with building construction.
 - 1. At point support fittings identify manufacturer's part numbers, dimensions, materials, finishes, connections and method of anchorage to structure.
- C. Samples:
 - 1. Aluminum Samples: Submit 3 inches square samples of selected finish.
- D. Delegated-Design Submittal: For metal canopies.
 - 1. Certification: Shop drawings shall be signed and stamped by Professional Structural Engineer.
 - 2. Calculations: Submit signed and stamped structural calculations for the work. Submittal will be for information only.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain all required canopy components through one source from a single manufacturer.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for metal canopies' aesthetic effects and performance characteristics. 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 construction.
 - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review
- C. Manufacturer Qualifications: Company specializing in manufacturing and fabrication of metal canopy systems, with minimum 5 years documented experience. Provide proof of qualifications.

1.05 COORDINATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to locate existing structure and support locations.

PART 2 - PRODUCTS**2.01 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design outdoor sun control devices, including comprehensive engineering analysis using structural performance requirements and design criteria indicated.
- B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
 - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

2.02 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mapes Canopies
 - b. Architect approved substitution
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing, doors, louvers and accessories, from single manufacturer.

2.03 MATERIALS

- A. Decking shall consist of 3" extruded flat soffit .078 aluminum decking.
- B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown.
- C. Fascia shall be standard extruded 8" aluminum J style.

2.04 ACCESSORIES

- A. Anchor Bolts: Galvanized steel, ASTM A307, Grade A.
- B. Sealant: Silicone sealant meeting requirements of Section 079200 "Joint Sealants," color as selected by Architect from full range of manufacturer.
- C. Exposed Flashing: As specified in Section 076200 "Sheet Metal Flashing and Trim."

2.05 FABRICATION

- A. General: Complete fabrication, assembly, finishing, and other work in the factory to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
 - 2. Perform fabrication operations in manner that prevents damage to exposed finish surfaces.
 - 3. Form profiles that are sharp, straight, and free of defects or deformations.
 - 4. Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
 - 5. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Downspout From Fascia.
 - 6. Allow for thermal expansion of exterior units.
 - 7. Fabricate canopy system to meet performance criteria specified.
 - 8. Prepare components to receive anchor and connection devices and fasteners. Provide fasteners with finish matching the framing members or trim.

2.06 ALUMINUM FINISHES

- A. General: Finishes shall be in compliance with NAAMM - Metal Finishes Manual for Architectural and Metal Products. Finish sun control devices after assembly.
- B. High-Performance Organic Finish - Mica Fluoropolymer: AAMA 2605. Two-coat fluoropolymer finish with suspended mica flakes containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1. Color and Gloss: Match Architect's sample.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine the supporting structure and substrate for dimensions and tolerances, material conditions, and support before beginning installation. Check carefully provisions for anchorage and adjustment, allowances for expansion and contraction, and conditions of flashings and flashing connections.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation indicates acceptance of conditions.

3.02 INSTALLATION

- A. General: Install meeting requirements of Contract Documents, including requirements specified in Part 2 of this Section, as indicated by final reviewed submittals for the work, and instructions and recommendations of product manufacturers. Consult with manufacturer for conditions not covered by printed instructions.
- B. Defective Components: Do not install components which are observed to be defective, including warped, bowed, dented, abraded, and broken members, and including glass with edge damage. Remove such components and replace with new components as applicable before time of acceptance.
- C. Cutting: Do not cut, trim, and joint components during installation, in manner which would damage finish, decrease strength, and result in visual imperfection and failure in performance of work.
- D. Trueness: Install components level, plumb, square, true to line, free of warp and twist, correctly aligned, and with uniform joints and reveals. Maintain dimensional tolerances and alignment with adjacent work.
- E. Anchorage:
 - 1. Anchor components securely in place by permanent mechanical attachment system, which meets performance requirements and permit movements which are intended and necessary.
 - 2. Secure to supporting structure using methods of attachment permitting sufficient adjustment to accommodate construction tolerances and irregularities. Use non-staining and non-corrosive shims, anchors, fasteners, spacers, and fillers.
- F. Separations: Install separators as applicable on concealed contact surfaces of dissimilar materials, before assembly and installation, wherever there is possibility of corrosive, including electrolytic corrosion.

3.03 ADJUSTING AND CLEANING

- A. Protective Covering: Remove any temporary protective covering provided by manufacturer at time of Substantial Completion, except as otherwise instructed by manufacturer.
- B. Restoration: Restore work damaged during installation and construction period so no evidence remains of correction work. Clean and touch-up minor abrasions in finishes with air-dried coating that matches type, color, and sheen of, and is compatible with, factory applied coating. If results of restoration are not acceptable to Architect, remove damaged units and replace with new finished units.

C. Cleaning:

1. Clean work surfaces after installation, exercising care to avoid damage to finish surfaces. Remove protective material from prefinished surfaces, labels, dirt, and other substances. Remove dirt from corners.
2. Cleaning materials and methods shall meet instructions and recommendations of manufacturer and shall not be detrimental to materials and shall promote achievement of uniform appearance.
3. Maintain work in a reasonably clean condition throughout construction period, so that it will be without deterioration and damage, other than normal weathering, at time of acceptance. Immediately before time of final completion clean thoroughly, inside, and out.
4. Demonstrate proper cleaning methods and materials to Owner's maintenance personnel.

END OF SECTION

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

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. Plastic-laminate countertops.
- B. Related Requirements:
 - 1. Division 22 "Plumbing" for sinks and plumbing fittings.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, and fire-retardant-treated materials.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, electrical switches and outlets, arrangement and details of jointing, and other items installed in plastic-laminate countertops.
- C. Samples for Initial Selection:
 - 1. Plastic laminates.
- D. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
 - 2. Wood-grain plastic laminates, 12 by 24 inches, for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.

1.04 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For the following:
 - 1. Composite wood and agrifiber products.
 - 2. High-pressure decorative laminate.
 - 3. Adhesives.

1.05 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of products.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver countertops until painting and similar operations that could damage countertops have been completed in installation areas. If countertops must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.07 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install countertops until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where countertops 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.
- C. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops 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 PLASTIC-LAMINATE COUNTERTOPS**

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades indicated for construction, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: AWI Custom.
- C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Formica Corporation.
 - b. Lamin-Art, Inc.
 - c. Wilsonart International Holdings, Inc.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated on Drawings.
 - 2. Grain Direction: Parallel to cabinet fronts.
- E. Edge Treatment: Same as laminate cladding on horizontal surfaces; 1-1/2 inch deep, square self edge.
- F. Core Material: Medium-density fiberboard.
- G. Core Material at Sinks: Medium-density fiberboard made with exterior glue/adhesives.
- H. Core Thickness: 3/4 inch.
 - 1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.
- I. Back and End Splashes: Same material, same construction; square set, square top; plastic laminate edge finish to match face sheet.
- J. Backer Sheet: Provide plastic-laminate backer sheet, NEMA LD 3, Grade BKL, on underside of countertop substrate.

2.02 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.

2.03 ACCESSORY MATERIALS

- A. Fasteners: As recommended by fabricator for application. Exposed fasteners and associated exposed components shall be non-magnetic stainless steel.
- B. Adhesives: Chemical resistant, low-VOC waterproof adhesive as recommended by manufacturer.
- C. Joint Sealant: Mildew-resistant silicone as specified in Section 079200 "Joint Sealants".
 1. Color: As selected by Architect.

2.04 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
 1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- B. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- C. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches, unless otherwise indicated.
- D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on Drawings, finished to match.
- E. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates to receive plastic-laminate-clad countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of installation shall indicate acceptance of conditions.

3.02 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.03 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
 1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items.
 2. For countertops not made of exterior-glue particleboard or exterior-grade plywood containing sinks, seal edges of cutouts by saturating with varnish.

- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
 - 1. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Install countertops level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- E. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c..
 - 3. Seal junctures of tops, splashes, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.04 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Remove and replace countertops that are/have:
 - 1. Broken, chipped, stained or otherwise damaged.
 - 2. Defective joints, including misaligned joints.
 - 3. Interior countertops and joints not matching approved samples.
 - 4. Interior countertops not complying with other requirements.
- C. Clean countertops on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

SECTION 133419 - METAL BUILDING SYSTEMS**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. Metal building systems that consist of integrated sets of mutually dependent components including primary and secondary structural framing members, roof panels, wall panels, connection bolts, roof extensions, sheeting, trim, flashing, fasteners, gutters, downspouts and other miscellaneous accessories.
- B. Related Requirements:
 - 1. Division 03 "Concrete" for cast-in-place concrete specifications for concrete foundations, slabs, and anchor-bolt installation.
 - 2. Section 072100 "Thermal Insulation" for insulation not covered as part of metal building systems work.
 - 3. Section 077200 "Roof Accessories" for roof curbs not included as part of metal building systems work.
 - 4. Section 083323 "Overhead Coiling Doors" for coiling doors in metal building systems.
 - 5. Section 083613 "Sectional Doors" for sectional doors in metal building systems.
 - 6. Section 084113 "Aluminum-Framed Entrances and Storefronts" for entrances and storefronts in metal building systems.
 - 7. Section 084413 "Glazed Aluminum Curtain Walls" for curtain wall in metal building system.
 - 8. Section 089119 "Fixed Louvers" for metal louvers in metal building systems.
 - 9. Section 099600 "High-Performance Coatings" for finish painting of shop-primed structural framing.

1.03 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in standards referenced by this Section.
- B. Bay: Dimension between main frames measured normal to frame (at centerline of frame) for interior bays, and dimension from centerline of first interior main frame measured normal to end wall (outside face of end-wall girt) for end bays.
- C. Building Length: Dimension of the building measured perpendicular to main framing from end wall to end wall (outside face of girt to outside face of girt).
- D. Building Width: Dimension of the building measured parallel to main framing from sidewall to sidewall (outside face of girt to outside face of girt).
- E. Clear Span: Distance between supports of beams, girders, or trusses (measured from lowest level of connecting area of a column and a rafter frame or knee).
- F. Eave Height: Vertical dimension from finished floor to eave (the line along the sidewall formed by intersection of the planes of the roof and wall).
- G. Clear Height under Structure: Vertical dimension from finished floor to lowest point of any part of primary or secondary structure, not including crane supports, located within clear span..

1.04 COORDINATION

- A. Coordinate sizes and locations of concrete foundations and casting of anchor-rod inserts into foundation walls and footings. Anchor rod installation, concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

- B. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.05 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. General: Review methods and procedures related to metal building systems including, but not limited to, the following:
 - a. Condition of foundations and other preparatory work performed by other trades.
 - b. Structural load limitations.
 - c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
 - d. Required tests, inspections, and certifications.
 - e. Unfavorable weather and forecasted weather conditions and impact on construction schedule.
 - 2. Roof Assembly: Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
 - b. Structural limitations of purlins and rafters during and after roofing.
 - c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
 - d. Temporary protection requirements for metal roof panel assembly during and after installation.
 - e. Roof observation and repair after metal roof panel installation.
 - 3. Wall Assembly: Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:
 - a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
 - b. Structural limitations of girts and columns during and after wall panel installation.
 - c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
 - d. Temporary protection requirements for metal wall panel assembly during and after installation.
 - e. Wall observation and repair after metal wall panel installation.

1.06 COORDINATION

- A. 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 03 "Concrete" cast-in-place concrete specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- C. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.07 ACTION SUBMITTALS

- A. Product Data: For each type of metal building system component.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Metal roof panels.
 - b. Metal wall panels.
 - c. Metal soffit panels.
 - d. Thermal insulation and vapor-retarder facings.
 - e. Translucent roof panels.
 - f. Roof ventilators.

- B. Shop Drawings: Indicate components by others. Include full building plan, elevations, sections, details and the following:
1. Anchor-Rod Plans: Submit anchor-rod plans and templates before foundation work begins. Include location, diameter, and minimum required projection of anchor rods required to attach metal building to foundation. Indicate column reactions at each location.
 2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.
 - a. Show provisions for attaching roof curbs .
 3. Metal Roof and Wall Panel Layout Drawings: Show layouts of panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, clip spacing, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.
 - a. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
 - b. Show wall-mounted items including personnel doors, vehicular doors, windows, louvers, and lighting fixtures.
 - c. Show translucent panels.
 4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.
 - b. Gutters.
 - c. Downspouts.
 - d. Service walkways.
 - e. Roof ventilators.
- C. Samples for Initial Selection: For units with factory-applied finishes.
- D. Samples for Verification: For the following products:
1. Wall and Roof Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
 2. Translucent Panels: Nominal 12 inches long by actual panel width.
 3. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
 4. Vapor-Retarder Facings: Nominal 6-inch- square Samples.
 5. Accessories: Nominal 12-inch- long Samples for each type of accessory.
- E. Delegated Design Submittals: For metal building systems.
1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.
 2. Shop drawings shall be signed and stamped by Professional Structural Engineer.

1.08 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For erector manufacturer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor retarders. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
- C. 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 including width, length, height, and roof slope.

6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 7. Governing building code and year of edition.
 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
 11. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.
- D. Manufacturer Certificate: Signed by manufacturer certifying that products comply with requirements.
- E. Other Certificates:
1. Erector Certificates: For qualified erector, from manufacturer.
 2. Welding certificates.
- F. Material Test Reports: For each of the following products:
1. Structural steel including chemical and physical properties.
 2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 4. Shop primers.
 5. Nonshrink grout.
- G. Source quality-control reports.
- H. Field quality-control reports.
- I. Sample Warranties: For special warranties.

1.09 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panel finishes[and door hardware] to include in maintenance manuals.

1.10 QUALITY ASSURANCE

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal building system and are based on the specific system indicated.
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- B. Manufacturer Qualifications: A qualified manufacturer.
1. Accreditation: Manufacturer's facility accredited according to IAS AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems."
 2. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.
 3. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.
- C. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project for minimum 5 years; and who is acceptable to manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.3, "Structural Welding Code - Sheet Steel."

1.11 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, sheets, 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. Protect foam-plastic insulation as follows:
 - 1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.
 - 3. Complete installation and concealment of foam-plastic materials as rapidly as possible in each area of construction.

1.12 FIELD CONDITIONS

- A. Weather Limitations: Proceed with panel installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

1.13 WARRANTY

- A. Special Warranty on Metal Panel Finishes: 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, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- B. Special Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that leak or otherwise fail to remain weathertight within specified warranty period.
 - 1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. A&S Building Systems, Inc.; a division of NCI.
 - 2. American Steel Building Company, Inc.; a division of NCI.
 - 3. American Buildings Company; a Nucor Company.
 - 4. Ceko Building Systems; an NCI company.
 - 5. Chief Buildings; Chief Industries, Inc.
 - 6. Gulf States Manufacturers; Nucor Company.
 - 7. Mesco Building Solutions; a division of NCI Building Systems, Inc.
 - 8. Metallic Building Company.
 - 9. Nucor Corporation, Nucor Buildings Group.
 - 10. Whirlwind Building Systems.

- B. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

- A. General: 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, metal roof panels, and metal wall panels, and accessories complying with requirements indicated.
1. Provide metal building system of size and with spacings, slopes, and spans indicated.
- B. Primary-Frame Type: One of following as indicated on Drawings:
1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.
 2. Rigid Modular: Solid-member, structural-framing system with interior columns.
 3. Long Bay: Solid- or truss-member, structural-framing system without interior columns.
 4. Lean-to: Solid- or truss-member, structural-framing system, designed to be partially supported by another structure.
- C. End-Wall Framing:
1. Typical: Manufacturer's standard, for buildings not required to be expandable.
 2. Expandable Buildings: Engineer end walls to be expandable. Provide primary frame, capable of supporting full-bay design loads, and end-wall columns.
- D. Secondary-Frame Type: Manufacturer's standard purlins and joists and girts.
- E. Eave Height: As indicated by nominal height on Drawings.
- F. Bay Spacing: As indicated on Drawings. Manufacturer to size framing members as required.
- G. Roof Slope: Manufacturer's standard for frame type required, unless otherwise indicated on Drawings.
- H. Roof System: Manufacturer's standard standing-seam and lap-seam metal roof panels, with insulation.
- I. Exterior Wall System: Manufacturer's standard field-assembled metal wall panels.

2.03 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal building system.
- B. Structural Steel: Comply with AISC's "Specification for Structural Steel Buildings--Allowable Stress Design, Plastic Design," or AISC's "Load and Resistance Factor Design Specification for Structural Steel Buildings," for design requirements and allowable stresses.
- C. Cold-Formed Steel: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members," or AISI's "Load and Resistance Factor Design Specification for Steel Structural Members," for design requirements and allowable stresses.
- D. Structural Performance: Metal building systems to withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
1. Design Loads: In accordance with codes and regulations of authorities having jurisdiction.
 - a. In lieu of appropriate state, local or model building codes meet requirements of MBMA's "Metal Building Systems Manual."
 2. Deflection and Drift Limits:
 - a. Design metal building system assemblies to withstand serviceability design loads without exceeding deflections and drift limits recommended in AISC Steel Design Guide No. 3 "Serviceability Design Considerations for Steel Buildings."
 - b. No greater than the following:
 - 1) Purlins and Rafters: Vertical deflection of $1/240$ of the span, or as required by local code, whichever is more stringent.

- 2) Girts: Horizontal deflection of 1/240 of the span, or as required by local code, whichever is more stringent.
- 3) Metal Roof Panels: Vertical deflection of 1/180 of the span, or as required by local code, whichever is more stringent.
- 4) Metal Wall Panels: Horizontal deflection of 1/180 of the span, or as required by local code, whichever is more stringent.
- c. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
- d. Provide metal panel assemblies capable of withstanding the effects of loads and stresses indicated, based on testing according to ASTM E1592.
- E. Seismic Performance: Design and engineer metal building systems capable of withstanding the effects of earthquake motions determined according to codes and regulations of authorities having jurisdiction.
- F. Thermal Movements: Provide metal panel systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- G. Fire-Resistance Ratings: Where assemblies are indicated to have a fire-resistance rating, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 or ASTM E108 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Combustion Characteristics: ASTM E136.
 2. Indicate design designations from UL's "Fire Resistance Directory," FM Global's "Approval Guide," or from the listings of another qualified testing agency.
 3. Metal panels shall be identified with appropriate markings of applicable testing and inspecting agency.
- H. Surface-Burning Characteristics: Provide field-insulated metal panels having thermal insulation and vapor-retarder-facing materials with the following surface-burning characteristics as determined by testing identical products per ASTM E84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
 1. Flame-Spread Index: 25 or less, unless otherwise indicated.
 2. Smoke-Developed Index: 450 or less, unless otherwise indicated.
- I. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
- J. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E1680 at the following test-pressure difference:
 1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- K. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- L. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:
 1. Test-Pressure Difference: 2.86 lbf/sq. ft.

- M. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 6.24 lbf/sq. ft., and not more than 12 lbf/sq. ft.
- N. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 90.
- O. Thermal Performance for Opaque Elements: Provide the following maximum U-factors and minimum R-values when tested according to ASTM C1363 or ASTM C518:
 - 1. Roof:
 - a. U-Factor: As indicated on Drawings.
 - b. R-Value: As indicated on Drawings.
 - 2. Walls:
 - a. U-Factor: As indicated on Drawings.
 - b. R-Value: As indicated on Drawings.

2.04 STRUCTURAL-STEEL FRAMING MATERIALS

- A. W-Shapes: ASTM A36; ASTM A992; or ASTM A572, Grade 50 or 55.
- B. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36; ASTM A572, Grade 50 or 55; or ASTM A529, Grade 50 or 55.
- C. Plate and Bar: ASTM A36; ASTM A572, Grade 55; or ASTM A529, Grade 50 or 55.
- D. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B, structural tubing.
- E. Structural-Steel Sheet: Hot-rolled, ASTM A 1011, Structural Steel (SS), Grade 55 for thickness of 0.125 inch to 0.175 inch; or ASTM A572, Grade 55 for thicknesses greater than 0.175 inch.
- F. Metallic-Coated Steel Sheet: ASTM A653, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G60 coating designation; mill phosphatized.
- G. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, Structural Steel (SS), Grades 33 through 80 or High-Strength Low Alloy Steel (HSLAS), Grades 50 through 80; with G90 coating designation.
 - 2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Structural Steel (SS), Grade 50 or 80; with Class AZ50 coating.
- H. Cable: ASTM A475, Coating Class A, Grade Extra High Strength 7 wire.
- I. Threaded Rods: ASTM A529, Grade 50.
- J. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders," with steel-angle, top- and bottom-chord members; with end- and top-chord arrangements as indicated and required for primary framing.
- K. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders," with steel-angle, top- and bottom-chord members; with end- and top-chord arrangements as indicated and required for secondary framing.
- L. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A, carbon-steel, hex-head bolts; ASTM A563 carbon-steel hex nuts; and ASTM F844 plain (flat) steel washers.
- M. High-Strength Bolts, Nuts, and Washers: ASTM A325, Type 1, heavy hex steel structural bolts; ASTM A563 heavy hex carbon-steel nuts; and ASTM F436 hardened carbon-steel washers.
- N. Primer: SSPC-Paint 15, Type I, . Grey Oxide Primer.

2.05 MATERIALS FOR FIELD-ASSEMBLED METAL PANELS

- A. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755.
 - 1. Steel Sheet: Provide one of the following:

- a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653, Structural Steel (SS), Grades 33 through 80, with G90 coating designation.
- b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792, Structural Steel (SS), Grade 50 or 80; with Class AZ50 coating designation.
2. Surface: Smooth finish.
3. Finishes: Apply the following coil coating, as specified or indicated on Drawings.
 - a. Exposed Finishes: Superior performance organic coating (PVDF) system.
 - b. Concealed Finish: Manufacturer standard backer finish.

2.06 STRUCTURAL STEEL FRAMING

- A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafters, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.
 1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.
- B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:
 1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch.
 2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; with minimum thickness of 0.0598 inch; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.
- C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jams, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:
 1. Purlins: Steel joists of depths indicated; or 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
 - a. Steel joists of depths indicated on Drawings.
 - b. Depth: As needed to comply with system performance requirements.
 2. Girts: C- or Z-shaped sections; fabricated from minimum 0.0598-inch- thick steel sheet, built-up steel plates, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees to flange and with minimum 2-1/2-inch- wide flanges.
 - a. Depth: As required to comply with system performance requirements.
 3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from 0.0598-inch- thick steel sheet, built-up steel plates, or structural-steel shapes; to provide adequate backup for metal panels.
 4. Flange Bracing: Minimum 2-by-2-by-1/8-inch (51-by-51-by-3-mm) structural-steel angles or 1-inch- (25-mm-) diameter, cold-formed structural tubing to stiffen primary-frame flanges.
 5. Sag Bracing: Minimum 1-by-1-by-1/8-inch (25-by-25-by-3-mm) structural-steel angles.
 6. Base or Sill Angles: Manufacturer's standard base angle, minimum 3-by-2-inch (76-by-51-mm), fabricated from zinc-coated (galvanized) steel sheet.
 7. Purlin and Girt Clips: Minimum 0.0598-inch- thick, steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
 8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from minimum 0.0598-inch- thick, zinc-coated (galvanized) steel sheet.
 9. 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.

10. 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.
- D. Bracing: Provide adjustable wind bracing [using any method] as follows:
1. Rods: ASTM A36/A36M; ASTM A572/A572M, Grade 50 (345); or ASTM A529/A529M, Grade 50 (345); minimum 1/2-inch- (13-mm-) diameter steel; threaded full length or threaded a minimum of 6 inches (152 mm) at each end.
 2. Cable: ASTM A475, minimum 1/4-inch- (6-mm-) diameter, extra-high-strength grade, Class B, zinc-coated, seven-strand steel; with threaded end anchors.
 3. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.
 4. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.
- E. Bolts: Provide plain finish bolts for structural-framing components that are primed or finish painted. Provide hot-dipped galvanized bolts for structural-framing components that are galvanized.

2.07 METAL ROOF PANELS

- A. Standing-Seam Metal Roof Panels: Formed with ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.0239 inch (24 gage) minimum base steel thickness.
 - a. Exterior Finish: Superior performance organic coating (PVDF) system.
 - b. Color: As selected by Architect from manufacturer's full range.
 2. Clips: Manufacturer's standard, floating type to accommodate thermal movement; fabricated from zinc-coated (galvanized) steel, aluminum-zinc alloy-coated steel, or stainless-steel sheet.
 3. Joint Type: Mechanically seamed, folded as standard with manufacturer to meet specified performance requirements.
 4. Panel Coverage: 16 inches.
 5. Panel Height: 2 inches.
 6. Uplift Rating: UL 90 or FM 1-120, as required for location and to meet codes and standards of authorities having jurisdiction.
- B. Lap-Seam Metal Roof Panels: Formed with raised major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.0179 inch (26 gage) thick.
 - a. Exterior Finish: Superior performance organic coating (PVDF) system.
 - b. Color: As selected by Architect from manufacturer's full range.
 2. Major-Rib Spacing: 12 inches o.c.
 3. Panel Coverage: 36 inches.
 4. Panel Height: 1-1/4 inches.
 5. Uplift Rating: UL 90 or FM 1-120, as required for location and to meet codes and standards of authorities having jurisdiction.

2.08 METAL WALL PANELS

- A. Berridge Deep-Deck Panel, pre-finished corrugated panel with exposed-Fastener Metal Wall Panels: Formed with raised corrugated ribs; designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - 1. Material: Zinc-coated (galvanized or aluminum-zinc alloy-coated steel sheet, 0.0239 inch (24 gage) minimum base steel thickness).
 - a. Exterior Finish: Superior performance organic coating (PVDF) system.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 2. Major-Rib Spacing: 7.2 inches o.c.
 - 3. Panel Coverage: 36 inches.
 - 4. Panel Height: 1.5 inches.
- B. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - 1. Material: Zinc-coated (galvanized or aluminum-zinc alloy-coated steel sheet, 0.0179 inch (26 gage) minimum base steel thickness).
 - a. Exterior Finish: Superior performance organic coating (PVDF) system.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 2. Major-Rib Spacing: 12 inches o.c.
 - 3. Panel Coverage: 36 inches.
 - 4. Panel Height: 1-1/4 inches.
- C. Tapered-Rib-Profile, Metal Liner Panels: Formed with raised, trapezoidal major ribs and intermediate stiffening ribs symmetrically spaced between major ribs; designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps.
 - 1. Material: Zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet, 0.0159 inch (28 gage) minimum base steel thickness).
 - a. Exterior Finish: Siliconized polyester.
 - b. Color: As selected by Architect from manufacturer's full range.
 - 2. Major-Rib Spacing: 12 inches o.c.
 - 3. Panel Coverage: 36 inches.
 - 4. Panel Height: 1-1/4 inches.

2.09 THERMAL INSULATION

- A. Metal Building Insulation: ASTM C 991, Type II, glass-fiber-blanket insulation; 0.5-lb/cu. ft. density; unfaced and with a flame-spread index of 25 or less.
 - 1. Vapor-Retarder: White continuous woven 1.2 mil HDPE interior facing scrim liner system with permeance not greater than 0.02 perm when tested according to ASTM E96, Desiccant Method.
 - 2. Thickness: As indicated on Drawings.
- B. Retainer Strips: 0.019-inch- thick, formed, galvanized steel or PVC retainer clips colored to match insulation facing.
- C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- D. Thermal Break Tape: Single sided thermal break tape, pvc foam carrier with acrylic adhesive, 1/4" thickness, width to match pre-engineered metal building girt sizes, R value 1.15.

2.10 TRANSLUCENT PANELS

- A. Uninsulated Translucent Panels: Glass-fiber-reinforced polyester, translucent plastic; complying with ASTM D3841, Type CC1 (limited flammability), Grade 1 (weather resistant); smooth finish on both sides. Match profile of adjacent metal panels.

1. Roof Panel Weight: Not less than 8 oz./sq. ft.
 2. Wall Panel Weight: Not less than 6 oz./sq. ft.
 3. Light Transmittance: Not less than 55 percent according to ASTM D1494.
 4. Metal Edge: Fabricate full length of each side of panel with metal edge for seaming into standing-seam roof panel joint.
 5. Color: As selected by Architect from standard of manufacturer.
- B. Performance:
1. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
- C. Mastic for Translucent Panels: Nonstaining, saturated vinyl polymer as recommended by translucent panel manufacturer for sealing laps.

2.11 ACCESSORIES

- A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.
1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
- B. Fasteners and Hardware: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners as required to withstand design loads, and to provide a complete installation.
1. Provide metal backed elastomeric washers under heads of fasteners bearing on weather side of panels of type recommended by manufacturer.
 2. Provide fasteners exposed to view in the completed Work with heads matching color of roofing or wall panel sheets by means factory applied coating.
- C. Roof Panel Accessories: Provide components required for a complete metal roof panel assembly including copings, fasciae, corner units, ridge closures, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same material as metal roof panels.
 2. Clips: Manufacturer's standard, formed from sheet, designed to withstand negative-load requirements.
 3. Cleats: Manufacturer's standard, mechanically seamed cleats formed from sheet.
 4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 5. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
 6. Thermal Spacer Blocks: Where metal panels attach directly to purlins, provide thermal spacer blocks of thickness required to provide 1-inch standoff; fabricated from extruded polystyrene.
- D. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal wall 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- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- E. Flashing and Trim: Formed from minimum 0.0159-inch- thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.
1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 2. Opening Trim: Minimum 0.0159 inch thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.
- F. Gutters: Fabricated from minimum 0.0428-inch- thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding indicated loads and of size and height indicated.
1. Gutter Supports: Fabricated from same material and finish as gutters; spaced 36 inches o.c.
 2. Strainers: Bronze, copper, or aluminum wire ball type at outlets.
- G. Downspouts: Formed from 0.0159-inch- thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal wall panels. Fabricate in minimum 10-foot- long sections, complete with formed elbows and offsets.
1. Mounting Straps: Fabricated from same material and finish as gutters, ; spaced 10 feet o.c.
- H. Roof Curbs: Fabricated from minimum 0.0428-inch- thick, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding indicated loads and of size and height indicated.
1. Curb Subframing: Minimum 0.0528-inch- thick, angle-, C-, or Z-shaped steel sheet.
 2. Insulation: 1-inch- thick, rigid type.
- I. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.12 MISCELLANEOUS MATERIALS

- A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.
1. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM or neoprene sealing washer.
 2. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with nylon or polypropylene washer.
 3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
 4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

- B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
- D. Metal Panel Sealants:
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
 - 2. 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 metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.13 FABRICATION

- A. General: Design components and field connections required for erection to permit easy assembly.
 - 1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.
 - 2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members to be free of cracks, tears, and ruptures.
- B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.
- C. Primary Framing: 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.
 - 1. Make shop connections by welding or by using high-strength bolts.
 - 2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
 - 3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
 - 4. Weld clips to frames for attaching secondary framing if applicable, or punch for bolts.
 - 5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.
- D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll forming or break forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.
 - 1. Make shop connections by welding or by using non-high-strength bolts.
 - 2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.
- E. Metal Panels: Fabricate and finish metal panels at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
 - 1. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of metal panel.

2.14 FINISHES

- A. General:

1. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 2. 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 the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- B. Factory-Primed Finish: Apply specified primer immediately after cleaning and pretreating.
1. Prime primary, secondary, and end-wall structural-framing members to a minimum dry film thickness of 1 mil.
 2. Prime secondary steel framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.
 3. Prime galvanized members with specified primer, after phosphoric acid pretreatment.
- C. Superior Performance Organic Coating (PVDF) System - Standard 2 Coat: AAMA 2605 standard two coat, thermally cured polyvinylidene fluoride (PVDF) system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
1. Color and Gloss: As selected by Architect from standard of manufacturer.
- D. Siliconized Polyester Finish: Siliconized polyester finish shall be high performance, heavy duty, silicone modified polyester resin paint system standard of manufacturer.
- E. Backer Finish: Apply pretreatment and manufacturer's standard white or light-colored backer finish, consisting of prime coat and wash coat with a total minimum dry film thickness of 0.5 mil.

2.15 SOURCE QUALITY CONTROL

- A. Special Inspection: Owner will engage a qualified special inspector to perform the following tests and inspections and to submit reports. Special Inspector will verify that manufacturer maintains detailed fabrication and quality-control procedures and will review the completeness and adequacy of those procedures to perform the Work.
1. Special inspections will not be required if fabrication is performed by a manufacturer registered and approved by authorities having jurisdiction to perform such Work without special inspection.
 - a. After fabrication, submit certificate of compliance with copy to authorities having jurisdiction certifying that Work was performed according to Contract requirements.
- B. Tests and Inspections:
1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1 and the following inspection procedures, at inspector's option.
 - a. Liquid Penetrant Inspection: ASTM E165.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94.
- C. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Erector, listing conditions detrimental to performance of work.
- B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.
 1. Engage land surveyor to perform surveying.
- C. Proceed with erection only after unsatisfactory conditions have been corrected. Commencement of erection indicates acceptance of conditions.

3.02 PREPARATION

- A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.
- B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.03 ERECTION OF STRUCTURAL FRAMING

- A. Erect metal building system according to manufacturer's written instructions and drawings.
- B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.
- C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.
- D. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Make allowances for difference between temperature at time of erection and mean temperature when structure will be completed and in service.
- F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. 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.
- G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Fasten secondary framing to primary framing using clips with field connections using non-high-strength bolts.
 1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
 2. Locate and space wall girts to suit openings such as doors and windows.
 3. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

- H. Steel Joists and Joist Girders: Install joists, girders, and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders," joist manufacturer's written instructions, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Bolt joists to supporting steel framework using high-strength structural bolts, unless otherwise indicated. Comply with RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for high-strength structural bolt installation and tightening requirements
 - 5. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- I. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.
 - 1. Tighten rod and cable bracing to avoid sag.
 - 2. Locate interior end-bay bracing only where indicated.
- J. 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 structural framing.
- K. Erection Tolerances: Maintain erection tolerances of structural framing within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.04 METAL PANEL INSTALLATION, GENERAL

- A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.
 - 1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.
- B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.
 - a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.
 - 2. Install metal panels perpendicular to structural supports unless otherwise indicated.
 - 3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 6. Lap metal flashing over metal panels to allow moisture to run over and off the material.
- C. Lap-Seam Metal Panels: Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or metal panels. Install screws in predrilled holes.
 - 1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
- E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.
 - 1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.05 METAL ROOF PANEL INSTALLATION

- A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.
 - 1. Install ridge and hip caps as metal roof panel work proceeds.
 - 2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.
- B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.
 - 1. Install clips to supports with self-drilling or self-tapping fasteners.
 - 2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
 - 3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
 - 4. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so that clip, metal roof panel, and factory-applied sealant are completely engaged.
 - 5. Rigidly fasten eave end of metal roof panels and allow ridge end free movement for thermal expansion and contraction. Predrill panels for fasteners.
 - 6. Provide metal closures at peaks, rake edges, rake walls, and each side of ridge and hip caps.
- C. Lap-Seam Metal Roof Panels: Fasten metal roof panels to supports with exposed fasteners at each lapped joint, at location and spacing recommended by manufacturer.
 - 1. Provide metal-backed sealing washers under heads of exposed fasteners bearing on weather side of metal roof panels.
 - 2. Provide sealant tape at lapped joints of metal roof panels and between panels and protruding equipment, vents, and accessories.
 - 3. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps and on side laps of nesting-type metal panels, on side laps of ribbed or fluted metal panels, and elsewhere as needed to make metal panels weatherproof to driving rains.
 - 4. At metal panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.
- D. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.
- E. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.06 METAL WALL PANEL INSTALLATION

- A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
 2. Shim or otherwise plumb substrates receiving metal wall panels.
 3. When two rows of metal panels are required, lap panels 4 inches minimum.
 4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
 5. Rigidly fasten base end of metal wall panels and allow eave end free movement for thermal expansion and contraction. Predrill panels.
 6. Flash and seal metal wall panels with weather closures at eaves and rakes, and at perimeter of all openings. Fasten with self-tapping screws.
 7. Install screw fasteners in predrilled holes.
 8. Install flashing and trim as metal wall panel work proceeds.
 9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated on Drawings; if not indicated, as necessary for waterproofing.
 10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
 11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.
- B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.
1. Field-Insulated Assemblies: Install thermal insulation as specified. Install metal liner panels over insulation on interior side of girts at locations indicated. Fasten with exposed fasteners as recommended by manufacturer.
- C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, noncumulative; level, plumb, and on location lines; and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.07 TRANSLUCENT PANEL INSTALLATION

- A. Translucent Panels: Attach translucent panels to structural framing with fasteners according to manufacturer's written instructions. Install panels perpendicular to supports unless otherwise indicated. Anchor translucent panels securely in place, with provisions for thermal and structural movement.
1. Provide end laps of not less than 4 inches and side laps of not less than 1-1/2-inch corrugations for metal wall panels.
 2. Align horizontal laps with adjacent metal panels.
 3. Seal intermediate end laps and side laps of translucent panels with translucent mastic.

3.08 THERMAL INSULATION INSTALLATION

- A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.
1. Install blankets straight and true in one-piece lengths. Install interior facing continuous woven HDPE scrim.
- B. Blanket Roof Insulation: Comply with the following installation method, as required to meet local energy code requirements:
1. Over-Framing Installation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal roof 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. Install layer of filler insulation over first layer to fill space formed by metal roof panel standoffs. Hold in place by panels fastened to standoffs.
 3. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.
 4. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
- C. Blanket Wall Insulation: Extend insulation and vapor retarder over and perpendicular to top flange of secondary framing. Hold in place by metal wall panels fastened to secondary framing.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.
 2. Sound-Absorption Insulation: Where sound-absorption requirement is indicated for metal liner panels, cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.
- D. Board Wall Insulation: Extend board insulation in thickness indicated to cover entire wall. Hold in place by metal wall panels fastened to secondary framing. Comply with manufacturers' written instructions.
1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.09 ACCESSORY INSTALLATION

- A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
 3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.
- B. 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. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without excessive oil-canning, 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 to result in waterproof and weather-resistant performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Gutters: Join sections with riveted-and-soldered or lapped-and-sealed joints. Attach gutters to eave with gutter hangers spaced as required for gutter size, but not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

- D. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
- E. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.
- F. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.10 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform field quality control special inspections and to submit reports.
- B. Tests and Inspections:
 - 1. High-Strength, Field-Bolted Connections: Connections shall be tested and inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - 2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1 and the following inspection procedures, at inspector's option:
 - a. Liquid Penetrant Inspection: ASTM E165.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94.
- C. Correct deficiencies in Work that test reports and inspections indicate do not comply with the Contract Documents.

3.11 CLEANING AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- C. Touchup Painting:
 - 1. After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing and accessories.
 - a. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
 - b. Apply a compatible primer of same type as shop primer used on adjacent surfaces.
- D. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
 - 1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 230506 – BASIC HVAC MATERIALS AND METHODS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 DEFINITIONS

- A. The word "building" used throughout these specifications shall be interpreted to mean the entire Building Complex.
- B. The term "The Professional" shall refer to the Architect or Engineer.
- C. Where the phrase "or approved equivalent," "or equivalent" or "approved" appears in these specifications, it shall refer to the approval of the Professional on the material or equipment involved.
- D. The terms "The Contractor" or "This Contractor" or "the HVAC Contractor" mentioned in these specifications refers to the Contractor responsible for the work and equipment included in these specifications.

1.03 CODES AND STANDARDS

- A. The work shall be executed, and the equipment constructed and installed in accordance with the requirements of the State Building Code, the Department of Labor and Industry, ASME, Department of Environmental Resources, Department of Labor, Safety and Health Regulations for Construction, OSHA, National Fire Protection Association, the National Electrical Code as amended to date of bidding, and applicable federal, state, county and local ordinances and regulations.
- B. Nothing contained in these specifications or shown on the drawings shall be construed to conflict with the aforesaid codes, ordinances, or regulations.

1.04 PERMITS AND CERTIFICATES

- A. The fees and permits required shall be satisfied and obtained by the Contractor and the cost shall be included in the Contract price.
- B. Certificates of approval shall be obtained from any department issuing same and shall be turned over to the Owner at the completion of the work.

1.05 QUESTIONS AND CLARIFICATIONS OF BID DOCUMENTS

- A. Bidders shall not rely on any verbal clarification of the Drawings and Specifications.
- B. Any questions or clarifications shall be referred to the Engineer at least seven (7) working days prior to bidding to allow for issuance of an addendum.

1.06 GENERAL REQUIREMENTS

- A. **No piping, ductwork or equipment shall be installed without first obtaining sign off from the other trades. Should such installation occur, and then subsequent conflicts arise, this Contractor shall, at his own expense, remove that which is in conflict and reinstall appropriately.**
- B. The Contractor shall visit the site and thoroughly acquaint himself with conditions existing at the site before submitting his proposal as he will be held responsible for the complete installation of the work in every detail.
- C. The Contractor shall carefully examine the general building drawings, and the mechanical and electrical drawings, and carry on his work so as not to delay or interfere with the work of other trades. He shall obtain in writing from the other contractors such data as is necessary to coordinate his work with other trades.

- D. Carefully examine the drawings included under this Contract and drawings included under other contracts and report any discrepancies noticed to the Professional as this contractor shall be responsible for the HVAC system installation in its entirety.
- E. The drawings are diagrammatic and generally indicative of the work to be installed. Due to the small scale of the drawings, it is not possible to indicate all offsets, fittings, valves, dampers, access panels, and similar parts which may be required. The Contractor shall carefully investigate the structural and finish conditions affecting the work and arrange his work, accordingly, furnishing necessary parts and equipment as may be required to meet the various conditions.
- F. The work shown on the drawings and not specifically included in the specifications shall be considered a part of the Contract work. The work included in the specifications and not specifically included on the drawings shall also be considered a part of the Contract work.
- G. The Contractor will be responsible for the completion of the work included under this Contract and shall employ skilled and qualified tradesmen as necessary to satisfactorily complete the work and trades.
- H. The work shall be installed subject to the approval of the Professional.

1.07 SCHEDULE OF WORK

- A. The Contractor shall arrange his work to comply with the project schedule and the published or revised phasing schedule.
- B. The Contractor shall submit a complete schedule of work to the Professional for approval at the beginning of the Contract in accordance with the phasing schedule.
- C. The schedule shall clearly indicate the proposed order in which the various parts of the work will be undertaken, and the estimated time required for the completion of each part of the work.
- D. The work shall be coordinated with work being performed by contractors of other trades, with the Owner and phasing schedule.
- E. The installation of equipment shall follow the phasing schedule.
- F. The Contractor shall especially review the phasing schedule and ensure compliance with this schedule.
- G. The schedule of work may be revised periodically during the course of construction, but each revised schedule must be approved by the Professional.

1.08 SHOP DRAWINGS AND SUBMITTALS

- A. Refer to Professional's specifications for submittal requirements.
- B. A complete list of materials proposed for each installation shall be submitted to the Professional for review before delivery to the site.
- C. Prior to the installation of any equipment or materials, submit shop drawings and manufacturer's data for the items listed in the Submittal Log (Attachment A) in accordance with the Contract Documents.
- D. Submittal Log (Attachment A) shall serve as the Contractor's checklist to assure the complete submission of the required shop drawings and manufacturer's data.
- E. Equipment and materials furnished as part of this Contract shall be submitted for review whether listed on Submittal Log (Attachment A) or not.
- F. The submissions are the Contractor's documents, and the Professional's review or acceptance constitutes an acknowledgment that the documents have been submitted and nothing more.
- G. It is the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.
- H. **Any deviations from the design documents must be clearly identified so that the Professional may properly review such items.** It shall not be the Professional's responsibility to search out these deviations. If such deviations are not properly flagged for

the Professional's review, the Contractor shall be completely responsible for the consequences that might result from the deviations.

- I. The Contractor shall submit samples of materials for approval at the site as requested by the Professional. Such materials may be incorporated into the structures after serving their purpose as samples.
- J. At the close of the job, prior to final review, five (5) bound copies of operations and maintenance (O&M) manuals shall be submitted by transmittal to the Engineer for review and acceptance. In lieu of hard copy O&M manuals, the Contractor may submit two (2) copies on USB flash drives containing PDF files. O&M manuals, regardless of format, shall include the following:
 1. Equipment warranties.
 2. Contractors' warranties.
 3. Parts list and manuals for the equipment.
 4. Operating instructions (in writing).
 5. Written instructions on maintenance and care of the systems.
 6. Lubrication and recommended spare parts.
 7. Submit Record (As-Built) Drawings. Refer to Paragraph 3.3

1.09 SUBSTITUTIONS

- A. Where the Contractor elects to substitute approved materials or equipment for materials or equipment specified, as the basis of design. The Contractor will be held responsible for the structural, mechanical, and electrical changes required for their installation at no additional cost to the Owner. If additional engineering design is required, the Contractor shall reimburse the design engineer for the related costs.
- B. Throughout the Specifications, types of materials may be specified by manufacturer's name and catalog number in order to establish standards of quality and performance and not for the purpose of limiting competition. Unless specifically stated otherwise, the bidder may assume the phrase "or approved equivalent," except that the burden is upon the bidder to prove such equality. If the bidder elects to prove such equality, he must request the Professional's approval in writing to substitute such item for the specified item, and shall submit supporting data, and samples if required, to permit a fair evaluation of the proposed substitution with respect to quality, serviceability and warranty. Data pertinent to the proposed substitution shall be submitted to the Professional at least 10 days prior to the bid date for evaluation and review purposes. If the Professional accepts the proposed substitution, an addendum will be issued to the bidders advising them that this substitution will be acceptable from each bidder.
- C. Substitutions of equipment other than that specified must be very carefully checked to assure that no problems will occur due to dimensional differences, code requirements, connection points, weights, etc. Where the Contractor elects to substitute materials or equipment approved by the Professional for those specified, the Contractor will be held responsible for the architectural, structural, mechanical, and electrical changes required for the installation of the substituted materials at no additional cost to the Owner. Tests required to substantiate the equivalence of the material will be the obligation of the Contractor.
- D. When this Contractor desires to furnish equipment of a manufacturer other than that specified or intended, he shall include a complete specification of the substituted item, along with each submission copy of shop drawings, indicating the necessary modifications to the substituted product to satisfy the requirements of the Contract Specifications. Manufacturer's specifications shall be written as close as possible over the Contract Specifications and each paragraph shall bear the same paragraph number as the Contract Specifications so that close comparison can be made. Submissions will be rejected should they not include the comparison specification. Comparison specification shall be submitted for approval 10 days prior to the Bid Date. If prior approval is not obtained, no substitutions will be considered, and the Engineer reimbursed for time spent to reject and return such submission.
- E. The verification specification shall include the exact wording of the Contract Specification and the revised wording identified properly indicating each deviation proposed. If no deviations

are noted, the Contractor must furnish the material or equipment in accordance with the Contract Specifications.

- F. Should the Contractor elect to propose a substitution after the project has been awarded, the Contractor will be billed for the time spent by the Professional and his consultants in evaluating the proposed substitution. This billing shall occur whether the proposed substitution is accepted or rejected and shall be at the rate of the direct cost to the Professional times a 2.5 multiplier.
- G. The submissions are the Contractor's documents, and the Professional's review constitutes an acknowledgment that the documents have been submitted and nothing more. It is the Contractor's responsibility to check his own submissions for compliance with the Contract Documents and job conditions.

1.10 DRAWING DIMENSIONS, GRADES, AND ELEVATIONS

- A. Contractor shall layout his work from dimensions of Architectural and Structural Drawings and actual dimensions of equipment being installed.
- B. Layouts in congested areas should not be scaled from Mechanical and Electrical Drawings. Clearances shall be provided on each side of the equipment as required for proper maintenance purposes and as required by the Department of Labor and Industry, OSHA and the National Electrical Code.
- C. Grades, elevations and locations shown on the drawings are approximately correct; however, the Contractor shall field check and otherwise verify grades, elevations, locations, and dimensions at the site before proceeding with the work.
- D. The Contractor shall make necessary survey equipment available during construction and shall make use of such equipment wherever necessary to properly install his equipment.

1.11 MECHANICAL PLANS

- A. The mechanical plans are intended to be diagrammatic and are based on one (1) manufacturer's equipment.
- B. They are not intended to show every item in its exact location, the exact dimensions or the details of the equipment.
- C. The Contractor shall verify the actual dimensions of any specified or substituted materials and equipment to ensure that they will fit in the available space.
- D. The apparatus shall be located as closely as conditions will permit and deviations there from shall be made only with the consent of the Engineer and without additional charge.
- E. The right is reserved by the Engineer to make any reasonable changes in the location of the equipment prior to rough-in without invoking additional expense.
- F. This contractor shall be responsible to create and distribute for sign-off amongst other trades ductwork and HVAC piping coordination drawings. Refer to Subsection 3.5 for further clarification.

1.12 EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be manufactured in accordance with national standards established by manufacturer's associations, engineering and testing societies, such as NBMA, NEMA, ASTM, AMCA, ASME, ANSI, ACI, etc., where such standards have been established.
- B. Equipment shall be furnished by authorized manufacturer's representatives only. There shall be no exceptions to this requirement.
- C. In each case where equipment and materials are specified in the singular or plural number, it is intended that such reference shall apply to as many such items as are required to complete the installation.

- D. Equipment and materials of similar types shall be of the same manufacturer unless specifically indicated otherwise on the drawings or herein specified.
- E. Materials shall be strictly in accordance with the quality, style, and sizes as specified herein.
- F. Manufacturers' names and plate numbers are given in the specifications to denote a standard of quality, style, size, and type and shall exclude material of other manufacturers.
- G. The Contractor shall make final connections between equipment furnished under this Contract and equipment furnished under other contracts as noted.
- H. The materials used throughout shall be those of reputable manufacturers and shall be new and the best of their respective kinds.
- I. Equipment, components and materials shall be installed in a neat and professional manner in accordance with best trade practices, manufacturer's recommendations, and applicable codes and standards and by men skilled in each trade of the work assigned to them.
- J. The Contractor shall properly lubricate the moving parts of equipment and appurtenances installed under this Contract.

1.13 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT AND MATERIALS

- A. The Contractor shall be responsible for the condition of the equipment associated with the work until the date of substantial completion or warranty begins, whichever comes first. Damage to equipment incurred prior to this, based on the sole discretion of the Owner, CM, or Professional, shall be the contractor's responsibility to replace or repair to the satisfaction of said party, at no additional cost to the project. This includes, but is not limited to, damage from transit, site storage, off site storage, mishandling, or misuse during construction.
- B. The Contractor shall provide products that comply with the contract documents and are undamaged.
- C. Damaged products shall not be installed as part of the Work, except at the sole discretion of the Owner.
- D. The Contractor shall bear the costs related to replacing, repairing or refurbishing damaged products.
- E. The Contractor shall be entirely responsible for the apparatus, equipment and appurtenances furnished by him or his Subcontractors in connection with the work, and special care shall be taken to protect each component thereof in such manner as may be necessary or as may be directed.
- F. Protection shall include covers, crating, sheds, or other means to prevent dirt, grit, plaster, or other foreign substances from entering the working parts of machinery or equipment.
- G. Special care shall be taken to keep the open ends of pipes, ductwork, VAV/CAV Boxes and other equipment, etc., closed while in storage and during installation.
- H. Where equipment must be stored outside the building, it shall be fully covered and secured with heavy waterproof tarps and kept dry.
- I. Where equipment has been subjected to moisture, it shall be suitably dried out before placed in service.
- J. Piping, ductwork, materials and equipment shall be stored in areas as designated by the Professional.

1.14 LOCATIONS OF EQUIPMENT

- A. The actual runs and locations of the piping, ductwork, equipment, etc., shall be determined at the site and shall be installed to meet the various conditions at the building.
- B. It is the HVAC Contractor's responsibility to predetermine the exact locations of ductwork, piping, and equipment, and to notify the other contractors accordingly to avoid conflict with other lines and equipment.
- C. Any changes necessary to conceal pipes, ductwork or clear pipes and equipment of other trades shall be made without additional expense to the Owner.

- D. This Contractor shall be responsible to create ductwork and HVAC piping coordination drawings and distribute to other contractors for coordination and sign off. Refer to Subsection 3.5 for further clarification.
- E. The Professional reserves the right to revise locations of piping, ductwork, locations of equipment, etc., within the building as long as sizes remain the same.

1.15 CONSTRUCTION PENETRATIONS AND OPENINGS

- A. The General Contractor will provide chases and openings in walls, floors, ceilings, and partitions of new construction to receive pipelines, risers, ducts, and other equipment insofar as it is possible to predetermine the exact location, but the Contractor shall install his work sufficiently in advance of the building construction to permit his work to be built into place.
- B. The General Contractor will furnish openings for intakes in the new exterior walls of the building. These are located and shown on the Drawings and shall be coordinated between this Contractor and the General Contractor.
- C. This Contractor shall advise the General Contractor of the exact size and location of the chases and openings required for the installation of his work and shall check size and location of such chases and openings provided by the General Contractor.
- D. The Contractor shall furnish and place the sleeves required for pipes or ducts passing through new floors, walls and ceilings before such general construction work is built into place.
- E. The Contractor shall place the inserts required for hangers and supports, as the construction work progresses, so that unnecessary cutting of construction work will be eliminated.
- F. The Contractor shall do the cutting and patching required for the installation of his work.
- G. Where piping, ducts, or other equipment pass through existing or new fire or smoke barrier stops, walls, floors, or ceilings, this Contractor shall furnish and install sleeves and shall thoroughly seal openings around sleeves, pipes, etc. with fire and smoke resistant materials.
- H. Materials shall be furnished by the HVAC Contractor as required to maintain the fire rating of the walls, partitions, ceilings and floors in accordance with the requirements of NFPA, the state building codes and other applicable codes.

1.16 HEATING AND COOLING DURING CONSTRUCTION

- A. Advance work as rapidly as possible to permit the heating and cooling systems to be used when it is required for each area of the building.
- B. The Contractor shall coordinate the operation of the system with the Owner so that heat remains on in each area during construction.
- C. Provide the required temporary heat as directed by the Construction Manager.

1.17 TEMPORARY USE OF EQUIPMENT

- A. The permanent HVAC equipment, when installed, may be used for temporary services, with the consent of the Engineer. Should the permanent systems be used for this purpose the Contractor shall make each temporary connection required at his expense. The Contractor shall also repair or replace equipment as necessary due to damage, wear and tear, etc., leaving the same in "as new" condition.
- B. Permission to use the permanent equipment does not relieve the Contractor from the responsibility for any damages to the building construction and/or equipment which might result because of its use.
- C. A pre-start up conference shall be held with the Professional, Owner, Construction Manager, and Mechanical Contractor. Equipment shall not be started until after this meeting.
- D. No unit shall be operated during construction phases that create excess dust, debris, or odors in the space on each floor, such as but not limited to: drywall installation, sanding, painting, wood cutting, etc. Each unit serving that space shall be shut down during construction phases that are associated with these types of activities and may only be restarted with the approval of the General Contractor and Engineer. Any damages, wear and tear, etc. resulting from use during unapproved times shall be the responsibility of the

Mechanical Contractor to repair or replace as required at no additional cost to the project or owner.

E. During each phase of construction:

1. At a minimum, four complete sets of pre-filter media are required for each air handling unit. In each unit, install two sets of filter media during construction (more shall be required if construction activities dictate more frequent changes). In each unit, install one set of filter media at substantial completion. Leave one set of filter media in boxes in the appropriate mechanical room as a spare set for the Owner. The other filters shall be used by the Contractor during construction. Dispose of the used construction filter media.
2. At a minimum, two sets of final filter media are required for each air handling unit with a final filter housing. The first set shall be installed at the end of the job when air balance begins, and the second set shall be left in the appropriate mechanical room. Do not install final filters during construction.
3. On the outside face of each return air opening install a minimum of two sets of fiberglass filter media, such as cheesecloth, to be utilized as pre-filters for the "construction" filters. Install first set upon start-up and then install second set when first set is dirty. Dispose of the dirty construction filters. Change filters as often as necessary to keep air handling units from becoming dirty at no additional cost.

1.18 EXCAVATION AND BACKFILL

- A. Include any excavation and backfill as required for work included under this Contract.
- B. Work shall conform to the applicable state and local regulations governing safety provisions at excavation sites.

1.19 MANUFACTURERS' SERVICE PERSONNEL

- A. The Contractor shall furnish the services of manufacturers' representatives for the equipment furnished under these Contract Documents.
- B. The amount of factory service provided by the Contractor shall be as normally recommended and furnished by the various equipment manufacturers unless specified otherwise.
- C. Testing of such systems and equipment shall be made under the direct supervision of competent authorized service representatives.
- D. In the instance of Mechanical and Control systems, such as the major and special equipment, heating equipment, controls, fans, or similar miscellaneous systems and equipment, the installations, final connections and testing of such systems shall be made under the direct supervision of competent authorized service engineers who shall be employed by the respective equipment manufacturer and/or an authorized representative.
- E. The expenses incurred by these equipment manufacturers' representatives shall be borne by the Contractor.

1.20 INSPECTIONS AND TESTS

- A. Prior to acceptance, the Contractor shall notify the Professional, in writing, when the installation is complete and ready for inspections and tests.
- B. If the installation does not comply with the contract documents, the Contractor shall immediately correct each defect and shortcoming.
- C. Any additional tests that may be required shall be entirely at the Contractor's expense. Testing shall be completed as directed by the Professional before the system is accepted.

PART 2 - PRODUCTS

2.01 MANUAL MOTOR STARTERS

- A. Manual motor starters shall be furnished by this Contractor, for installation by the Electrical Contractor, for single phase fractional horsepower (1/2 horsepower and smaller) motors.

- B. Provide the motor electrical characteristics to the Electrical Contractor so the Electrical Contractor may size wiring.
- C. The Heating Contractor shall coordinate the starter control circuit transformer VA requirements with the ATC contractor prior to ordering starters.

2.02 DISCONNECT (SAFETY) SWITCHES

- A. Disconnect switches shall be furnished to the Electrical Contractor for installation.
- B. Disconnect switches shall be of the fusible type as indicated, quick make, quick break in NEMA Type 1 sheet steel enclosure unless otherwise noted.
- C. Disconnect switches shall be horsepower rated, and of size and number of poles as indicated on the Drawings. Safety switches shall be of type having a direct mechanical linkage between contacts and operating handle.
- D. Disconnect switches shall be as manufactured by Cutler-Hammer, General Electric, or Square D Company.
- E. Fuses for disconnect switches shall be of the UL Class RK1 Low Peak as manufactured by the Bussmann Mfg. Division of the McGraw Edison Company.
- F. Fuses for motors shall be sized to conform with the motor running current and in strict accordance with the recommendations of the fuse manufacturer.
- G. Where disconnect switches are located at the exterior of the building or in wet locations, they shall be provided with NEMA 3R or 4 weather tight and weather resistant enclosures.
- H. Enclosures for disconnect switches located in hazardous areas shall be of the appropriate explosion proof type.
- I. Disconnect switches used as service entrance switches shall be Underwriters Laboratories listed suitable for Service Entrance Equipment.
- J. Disconnect switches serving remotely mounted soft starters or VFD's shall be furnished with a minimum of one (1) set of normally open auxiliary contacts.

2.03 FIRE STOPPING

- A. The following fire stopping requirements constitute minimum requirements of this specification. The Contractor shall be aware of additional requirements by the Construction Manager, which may exceed or supersede this specification.
- B. Seal openings of fire rated construction with a material or product that has been tested at an independent testing laboratory, such as UL, FM, etc. Fire stopping shall conform to ASTM E 814 and UL 1479, with fire ratings equal to or exceeding the fire rating of the construction involved. Fire stopping shall be UL classified, and shall be like the 3M brand Fire Barrier Penetration Sealing Systems, or approved equivalent. Fire stopping of this type shall also be utilized for openings through smoke rated construction.
- C. If desired by the Contractor and approved by local codes, the "Pro Set" piping penetration system also may be utilized. Penetration system shall be UL certified and shall be the "Pro Set" System A. Firestop coupling (sleeve) shall be filled with ceramic fiber material to provide insulation and fire stopping. System shall be capable of maintaining a 3 hour fire rating. Penetration system shall be secure, waterproof, fire rated, and smokeproof and shall allow for pipe expansion and contraction.

2.04 EQUIPMENT GUARDS

- A. Equipment guards shall be provided for protection at the belts, chains, gears, motors or other moving parts of equipment and machinery installed under this Contract.
- B. Guards shall be made up of suitable structural shapes and heavy gauge steel welded together and attached to equipment by removable clips and bolts.
- C. Guards shall be neat and substantial and shall be securely attached to equipment.
- D. After fabrication, guards shall be cleaned of rust and scale and painted with one coat of metal primer followed by two coats of enamel to match the equipment.
- E. Guards shall be easily removable for maintenance and service of equipment.
- F. Equipment guards shall conform to OSHA requirements.

2.05 CONCRETE WORK

- A. Furnish and install the concrete work related to work included under this contract.
- B. Construct concrete forms and bases for the new equipment installed under this contract.
- C. Bases and forms shall be of suitable dimensions for the equipment.
- D. The concrete work shall be constructed subject to the approval of the Professional.
- E. Provide the concrete for repair work related to work included under this Contract.
- F. For each piece of floor mounted equipment shown or specified to have a concrete base or pier built on existing floor slab, the Contractor shall install a floor slab of suitable size for the equipment to rest thereon.
- G. Each foundation shall extend 4" above the floor line (unless otherwise indicated on the drawings).
- H. Conform to specific equipment manufacturer's recommendations for construction of bases and foundations in each instance.

2.06 MISCELLANEOUS IRON WORK

- A. The HVAC Contractor shall furnish and install the necessary structural steel members for the proper support of the piping, ductwork, and equipment furnished and installed under this Contract.
- B. Miscellaneous iron work shall include, but not be limited to, piping hangers, piping anchors and guides, ductwork supports, and any other equipment supports.
- C. Additional structural members shall be furnished and installed to support the heating, ventilating and air conditioning equipment without excessive stress or strain on the building construction.
- D. Structural beams and other structural members shall be furnished and installed under this Contract for anchors and guides where the building steel is not available or capable of supporting or anchoring pipe lines and equipment.
- E. The equipment and materials furnished and installed under this Contract which are not mounted on bases or floors shall be securely attached and supported from the main supporting structure of the building by metal hangers, clamps and/or brackets.
- F. Metal hangers, clamps and/or brackets shall be of suitable design and of sufficient strength to properly and safely support the materials and equipment involved.
- G. Lag screws and bolts shall be used where required at wood construction.
- H. Materials:
 - 1. Structural steel members for the support of equipment installed under this Contract shall conform to ASTM Specifications A 36 and shall comply with the latest requirements of the American Institute of Steel Construction.
 - 2. Structural steel shall be of standard sections as given in the structural steel manufacturers' handbooks.
- I. Anchors:
 - 1. The Contractor shall provide the anchors, bolts, screws, dowels, and connecting members and perform the cutting and fitting necessary to secure the work to adjoining construction.
 - 2. Build in connecting members to masonry, concrete, and structural steel as the new and remodeling work progresses.
- J. Supports and Brackets:
 - 1. Supports and brackets shall be neatly constructed of structural shapes to adequately support the equipment intended.
 - 2. The supports must be approved prior to installation. Field conditions will regulate the type of support.
- K. Priming and Painting:

1. Before priming, the metal shall be thoroughly cleaned free from scale, rust, and dirt.
2. The steel and iron work shall be primed with Rust Oleum X 60, or approved equivalent.
3. Paint final coat black on the miscellaneous steel installed under this contract by this Contractor.

2.07 FLASHINGS

- A. The Contractor shall furnish and install roof curbs as required for his equipment.
- B. The Contractor shall furnish and install pipe portals for pipes as required.
- C. An approved roofing sub-contractor, responsible to the Heating Contractor, shall install flashings at roof curbs and final roofing, to maintain the roof warranty.

PART 3 - EXECUTION

3.01 CLEANING

- A. As the work in the building nears completion, threading, cutting, etc., shall be done where directed by the Professional.
- B. Upon completion of the work, the remaining waste materials and rubbish resulting from the Contract work shall be removed from the building and premises.
- C. At the completion of the work each part of the installation shall be thoroughly cleaned. Strainers, vents, pumps, etc., shall be cleaned of dirt. Temporary replaceable air filters shall be removed, and new replaceable air filters shall be installed after the areas have been cleaned for occupancy. The system shall be operated for a sufficient period to thoroughly remove grease, metal cuttings, and other foreign matter from the system.
- D. Any stoppage or any discoloration or other damage to any part of the building, its finish or furnishings due to the Contractor's failure to properly clean the piping, shall be repaired by the Contractor without cost to the Owner.
- E. New equipment installed under this Contract, existing remaining equipment, and new and existing furnishings and finishes soiled or damaged due to the work included under this Contract shall be thoroughly cleaned as required to remove plaster, dust, paint splashes, labels and debris.
- F. Steam Pipe Additions to Existing Systems:
 1. After new steam and condensate return piping is installed, feed the steam line treatment at a high level.
 2. Waste the condensate return from the new system to a drain. Do not return to the feed water system. Continue this operation until condensate is clear.
 3. Coordinate steam pipe cleaning with the Owner and his boiler plant chemical treatment provider.

3.02 INSTRUCTIONS TO OPERATING PERSONNEL

- A. Instruct the Operating Personnel as to the proper care and maintenance of the systems installed under this contract.
- B. The Contractor shall furnish the services of qualified personnel, approved by the Professional and thoroughly familiar with the completed installation to instruct the permanent operating personnel in the proper operation of the systems included under this Contract and the proper care of the equipment and apparatus. These services shall be furnished for a period of five 8 hour days after the operation of the building has been taken over by the Owner.
- C. When instructions are provided under this Contract, the Contractor shall have in his possession three copies of an identifying letter which shall list the names of the Contractor's qualified instruction personnel including manufacturers' representatives and subcontractors that will be giving instructions. Likewise, on the same letter, spaces shall be provided for the Owner's personnel who will receive the instructions. After instructions have been given and received for each system, the Contractor's representatives and subcontractors shall sign and

- date the letter, and the Owner's personnel shall sign and date the letter acknowledging that they have received adequate instructions for operating and maintaining the systems and equipment. One signed copy shall be delivered to the Owner, one copy to the Professional, and one copy shall be retained by the Contractor.
- D. In addition to the verbal instructions outlined above, the Contractor and his manufacturers' representatives and subcontractors shall furnish written basic instructions indicating the proper operation of each system and associated equipment. Each manufacturer shall also submit a brochure on his equipment including instructions on operation, lubrication, recommended spare parts, and instructions on preventative, routine, and breakdown maintenance. The brochures and formats must be approved by the Professional.
- E. The Contractor shall combine the written instructions and the manufacturers' equipment brochures in complete volumes with hard back binders which shall be turned over to the Owner before final acceptance of the Contract work. The Contractor shall furnish the Owner with three (3) complete sets of the manuals indexed by equipment and by manufacturer. The Contractor shall obtain two copies of a signed receipt from the Owner for the written instructions and equipment brochures. One copy of the receipt shall be delivered to the Professional and one copy retained by the Contractor.
- F. It is the intent that this entire system with its complement of equipment and auxiliary equipment operate properly in accordance with the design concept and functional intent. It is also the intent that the Owner be given complete instructions for the proper operation and maintenance of the entire system.

3.03 RECORD (AS-BUILT) DRAWINGS

- A. The Contractor shall maintain a complete set of Contract Drawings at the site and shall record each deviation in his work (in red ink or pencil) from that indicated on the Contract Drawings. Deviations shall be clearly and accurately recorded so that the Engineer can prepare final record (as-built) drawings using the Contractor's marked-up drawings. Dimensions shall be recorded using permanent reference points such as columns, building walls and like items. These record drawings shall be submitted to the Professional prior to final acceptance.

3.04 WARRANTY

- A. The Contractor shall warrant that the materials and construction quality in the erection of this installation are as herein specified, and he shall provide the necessary labor and materials required to make good any defects in same which become apparent within one year from date of final payment for completed work providing such defects are due to faulty materials or construction quality and not to misuse of apparatus by the Owner, his employees, or tenants. Certain equipment shall be warranted or guaranteed for longer than one year from date of final payment where specifically mentioned in these specifications.
- B. The equipment and materials manufacturers are expected to recognize that they are responsible for the failure of their products to perform in accordance with data furnished by them or their authorized representatives as well as misrepresentations of such data. When the products have been installed in accordance with the manufacturer's published or written instructions and recommendations and such products fail, then the Contractor and the manufacturers are responsible for replacement of the products and the associated work and materials without additional cost to the Owner. This warranty applies to each item supplied on the equipment and not just those that are the product of the manufacturer.

END OF SECTION

Submittal Log (Attachment A)**Project Name:** _____**CJL Project No.:** _____ **Trade:** _____Engineer's Review: A = Reviewed, B = Rejected, C = Furnish as Corrected, D = Comments AttachedContractor's Required Response: E = Confirm, F = Resubmit

No.	Specification Number	Description	Manufacturer	Date Received	Action Taken	Date Returned
	230506	O&M Manuals				
	230506	As-Built Drawings				
	230593	Testing, Adjusting, and Balancing of Systems (TAB Reports)				
	230700	HVAC Insulation				
	233113	Ductwork				
	233423	Supply and Exhaust Fans				
	233713	Air Outlets & Inlets				
	238214	Electric Heating Units				
	233713	Gas Fired Radiant Heaters				
	238116	Furnace and Condensing Unit				

SECTION 230593 – TESTING, ADJUSTING AND BALANCING OF SYSTEMS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. The Scope of the Work includes the performance of testing, adjusting, and balancing of the HVAC systems, following the procedures defined herein and the preparation and submission of balancing reports.
- B. Circulating water piping systems, air distribution systems, and other heating, ventilating, and air conditioning equipment and systems installed under this Contract shall be balanced under this Contract.

1.03 DEFINITIONS

- A. TAB – Testing, Adjusting and Balancing
- B. ATC – Automatic Temperature Controls

1.04 SUBMITTALS

- A. Experience and qualifications of the proposed TAB Contractor shall be submitted for review by the Professional.
 - 1. The TAB Contractor shall be independent of the HVAC Contractor and shall have at least 5 years' experience providing TAB services.
 - 2. The TAB Contractor shall provide qualifications for balancing variable air volume systems, including a list of previous projects.
- B. Prior to the start of the Work, the TAB Contractor shall submit to the Professional a list of the balancing equipment and instruments he intends to use. The equipment must be first approved before being used on the project.
- C. The HVAC Contractor shall submit three (3) hard copies, or a PDF file, for each of the following:
 - 1. Circulating water systems balancing report.
 - 2. Air systems and related equipment balancing report.
 - 3. ATC system.
- D. A written report shall be prepared and submitted to the Professional after each site visit when adjustments to the HVAC system are required during the first heating and cooling seasons that it is in operation.

1.05 GENERAL REQUIREMENTS

- A. The TAB Contractor shall be a sub-contractor to the HVAC Contractor and shall perform this work under the direction of the HVAC Contractor.
- B. The TAB Contractor shall be responsible for the testing, adjusting, and balancing work.
- C. The TAB Contractor shall be a member of the Associated Air Balance Council, or the National Environmental Balance Bureau. Balance reports shall be submitted on AABC or NEBB forms.
- D. Testing shall be as specified herein and in accordance with the aforementioned codes and best trade practices.
- E. The TAB Contractor shall furnish the labor, and supervision and shall furnish the instruments and provide the instrumentation required to perform the balancing work.
- F. Balancing of heating systems shall be performed when outside temperature is averaging less than 30 degrees F. and on cooling systems when outside temperature is above 80 degrees F.

- G. The HVAC Contractor shall enlist the cooperation of equipment manufacturers where needed to obtain proper equipment performance.
- H. The TAB Contractor shall furnish services for two (2) complete adjustments of the HVAC systems and controls, for the first cooling season and the first heating season. (A written report must be made to the Professional after each visit.)

1.06 DEMONSTRATION

- A. At the completion of the work and before final acceptance, the TAB Contractor shall place the piping, ductwork and equipment in proper operation, adjust the equipment, valves and control systems and make the necessary corrections.
 - B. The TAB Contractor shall make final adjustments to the equipment and controls as may be required for proper operation, maintaining correct temperature in every part of the facility which may be impacted by the HVAC Contract.
 - C. With approved supervisory employees, the HVAC Contractor, with the assistance of the TAB Contractor, shall demonstrate to representatives of the Professional and the Owner that the systems and equipment perform in accordance with their specific use as a part of the overall system and in accordance with the Contract requirements as evaluated and interpreted by the Professional or his representatives.
 - D. During the tests, it shall be demonstrated that the systems will operate correctly.
 - E. Controls will be adjusted by the control system manufacturer's mechanics and authorized representatives on the advice of the TAB Contractor.
 - F. Leaks, faulty equipment, and poor workmanship shall be repaired or replaced by the HVAC Contractor. The related additional costs of rebalancing shall be borne by the HVAC Contractor.
-
- G. The TAB Contractor shall study and report on noise and vibration problems, which may develop in the course of system balancing.
 - H. The HVAC Contractor, with the assistance of the TAB Contractor, shall perform the necessary corrective work required to demonstrate and prove the systems and equipment function in an approved manner.
 - I. The demonstrations shall continue until the systems operate satisfactorily as determined by the Professional and his representative.

PART 2 - PRODUCTS

2.01 NOT APPLICABLE TO THIS SECTION

PART 3 - EXECUTION

3.01 BALANCING OF AIR SYSTEMS

- A. Supervise and perform the balancing of the air conditioning and ventilating systems to achieve the air quantities specified at each air inlet, outlet and damper shown on the Contract Drawings at the proper conditions of static pressure and temperature differential.
- B. The supply air, return air, and exhaust systems, under the HVAC Contract, shall be accurately balanced by means of a velometer to the CFM noted on the Drawings and the dampers and registers securely locked into position.
- C. The duct system accessories shall be adjusted and set for the proper airflow quantities and conditions, and the TAB Contractor shall adjust and set fans, VFD's, sheaves, dampers and adjustment mechanisms, including mechanical air valves.
- D. Diffusers, registers, and grilles shall be set for proper air distribution and for comfortable conditions.
- E. The TAB Contractor shall follow the variable volume box or diffuser manufacturer's recommendations for balancing the variable volume air systems.

- F. Manual dampers, on the main supply air, return air, and exhaust duct risers at the shafts, shall each be tagged with the quantity of airflow and the static pressure set point of the damper. Tags shall be brass or aluminum and shall securely attached to the damper handle. The set point position on the damper shall be permanently marked.
- G. The entire air balance shall be completed before the water balance is started.

3.02 GENERAL REQUIREMENTS FOR BALANCING REPORTS

- A. These reports shall certify test methods and instruments used, the readings obtained, temperature and pressure drops, RPM of equipment, amperage of the motors, and balancing problems encountered and suggestions.
- B. Reports shall be submitted to the Professional and shall include data on the tests in the form normally used by AABC or NEBB; but varied as required to suit these specifications.

3.03 AIR SYSTEM BALANCE REPORT

- A. The air system balance report, prepared by the TAB Contractor, shall include the CFM at outlet or inlet of each grille, diffuser, and register.
- B. Report shall include fan curves for the final speeds developed from the fan manufacturer's performance test data for the major fans.
- C. With the air systems set to handle the normal outdoor air quantity, the TAB Contractor shall perform the following tests, compile information, and submit written reports to the Professional on the following:
 - 1. Air Handling Equipment
 - a. Design Conditions
 - 1) CFM Supply Air, and Exhaust Air (Each System)
 - 2) Static Pressure
 - 3) Motor HP
 - 4) Fan RPM
 - 5) Outlet Velocity
 - b. Installed Equipment
 - 1) Fan Manufacturer, Size, Model Number (Supply and Exhaust)
 - 2) Motor, Frame and Manufacturer
 - 3) Motor Size/Model Number
 - 4) Motor HP, Voltage, Phase, Full Load Amperage, RPM
 - 5) Belt size/Model Number, and number of belts
 - 6) Sheave size and make
 - 7) Sheave bore size
 - 8) Sheave keyway size
 - c. Field Test
 - 1) Fan Speed
 - 2) No load operation amperes
 - 3) Fan motor operating amperes
 - 4) Calculated BHP
 - d. Test for Total Air
 - 1) Exhaust Air CFM
 - 2. Individual inlets and outlets (Diffusers, Registers and/or Grilles)
 - a. Identify each outlet or inlet as to location area and fan system.
 - b. Manufacturer and type
 - c. Size
 - d. Free area, core area or neck area
 - e. Required FPM and test velocity found for each
 - f. Required CFM and test results for each

- D. Testing and adjusting of individual outlets shall be performed under procedures recommended by the manufacturers of the outlets.
- E. Outlets shall be set for air pattern required and air dampers shall be adjusted and set for design CFM indicated.
- F. Any required changes in air patterns, settings, or any other miscellaneous changes necessary for achieving correct air balance, shall be provided under this Contract.
- G. Total CFM of outlets shall agree with total CFM of branches and the grand total shall agree with the air volume for the fans.

END OF SECTION

SECTION 230700 – HVAC INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. The insulation for the various HVAC systems shall be as hereinafter described in this section.

PART 2 - PRODUCTS

2.01 GENERAL

- A. The materials, finish and adhesive herein specified, shall be listed and inspected by Underwriters Laboratories Incorporated. Covering, vapor barriers, and adhesives used in this application shall have a flame spread classification of not more than 25 and a smoke developed rating of not more than 50, based on tests in accordance with ASTM Standard E84, "Methods of Tests for Surface Burning Characteristics of Building Materials," except as hereinafter specified. Each product shall bear the label Underwriters Laboratories. Products used on this project shall be classified as "non-combustible" by NFPA.

2.02 REFRIGERANT PIPING INSULATION

- A. Suction and liquid piping less than or equal to 1-1/2", valves and accessories shall be insulated with 1" thickness Type FR Armaflex, or approved equivalent, flexible tubing insulation. Suction and liquid piping greater than 1-1/2" shall have 1.5" thick insulation.
- B. Insulation exposed to weather shall be covered with a Childers 0.016" smooth aluminum exterior weatherproof jacket neatly banded and sealed in place.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Insulation shall be installed by an Insulation Subcontractor responsible to the Heating Contractor. Insulation shall be installed in a neat and workmanlike manner by workmen skilled in the installation and handling of commercial and industrial insulation for piping, ductwork, and equipment.
- B. Insulation shall be installed as recommended by the insulation manufacturer.

END OF SECTION

SECTION 232301 - REFRIGERANT PIPING**PART 1 - GENERAL****1.01 SUMMARY**

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.02 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.03 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS**2.01 PIPING**

- A. Use clean, hard drawn, factory plugged type ACR (air conditioning refrigeration) copper tubing with wrought copper fittings. Installation of refrigerant piping requires that refrigerant piping be silver soldered. Therefore, it is incumbent that the Contractor provides valves and specialties which can be silver soldered without damaging internal parts. Disassemble valves and specialties before soldering. Appeal of this requirement after installation is completed will not be considered and work not conforming to specifications will be directed to be replaced. Silver solder composition: 15% silver, 80% copper, 5% miscellaneous metals and shall have maximum melting point of 1160°F. SIL-FOS as manufactured by Handy & Harmon, J.W. Harris Co., Inc., or equivalent. Do not use Lead or tin base solders. Final connections of refrigerant lines of 1/2" O.D. and under may be made with flare fittings.

2.02 VALVES

- A. Manual stop valves and check valves: as manufactured by Henry Valve Co., Mueller Brass Co., Superior Valve Co., or equivalent. Manual stop valves in liquid lines: packless type with handwheels.

PART 3 - EXECUTION**3.01 PREPARATION**

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Reroute piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and not interfere with use of space.
- D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.
- E. Provide non-conducting dielectric connections when joining dissimilar metals.
- F. Install piping to allow for expansion and contraction with stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access to valves and fittings.

- H. Provide access to concealed valves and fittings.
- I. Insulate piping; refer to Section 230700.
- J. Fully charge completed system with refrigerant after testing.

3.03 APPLICATION

- A. Provide line size liquid indicators in liquid line.
- B. Provide filter-driers in liquid lines with flared connection.
- C. Submit shop drawings on refrigeration equipment, complete wiring diagrams and refrigerant piping diagrams. Install wiring and piping in complete accordance with manufacturer's recommendations.
- D. Refrigerant piping diagrams shown on the drawings are the minimum acceptable required piping and accessories and generally show single piping circuits. During bidding stages, obtain circulating requirements of various refrigeration equipment vendors and include costs for installation of piping and accessories in bid proposal.
- E. Provide access fittings in piping system at suction lines near DX coil.

END OF SECTION

SECTION 233113 - DUCTWORK**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. The ductwork for the various HVAC systems shall be as hereinafter described in this section.

1.03 SUBMITTALS

- A. Submit shop drawings depicting dimensioned ductwork layouts.
- B. Submit duct construction standards for each ductwork pressure class required for this project.
- C. Shop drawings shall indicate assembly, duct dimensions, sheetmetal gauge or thickness, required clearances, construction details, and field connection details.
- D. Shop drawings shall define flange spacing dimensions and any additional reinforcement spacing dimensions.

1.04 GENERAL REQUIREMENTS

- A. The Contractor shall furnish and install sheet metal work as required for proper operation of the heating, ventilating and air conditioning system, supply air, return air, and exhaust ventilating systems.
- B. The Contractor shall be held responsible to construct the air handling systems in accordance with UL requirements for the combinations on the Project.
- C. Ductwork shall include low and medium velocity heating and air conditioning supply, outdoor air, return, relief, transfer, and exhaust ventilation, mains, branches, access doors, dampers, wall sleeves, canvas connections, accessories, as hereinafter specified, and the necessary supports, bracing, stiffeners and hangers to provide neat vibration proof air distribution systems.
- D. Ductwork sizes noted on the drawings refer to the internal free area of the ducts. Where duct liner is used, the Contractor shall adjust the external sheetmetal dimensions to maintain the internal free area of the ducts.
- E. The Heating Contractor shall be responsible for notifying the General Contractor where ductwork or other equipment will be extended through the roof and exterior walls. It will be necessary to coordinate the exact location of structural members to provide clearance for the ductwork.
- F. The duct systems shall be arranged to maximize clearance for access to various dampers and other accessories.
- G. An access door shall be provided to service each damper.
- H. Attention is called to the limited space available for ductwork and close cooperation will be required between this Contractor and contractors for other trades.
- I. Sheet metal work shall be fabricated and installed in a neat and workmanlike manner and by persons experienced in this type of work.
- J. Furnish and install structural steel members for the support of the ductwork and equipment to suit the structural and vibration isolation conditions.

PART 2 - PRODUCTS**2.01 LOW VELOCITY DUCTWORK**

- A. Low velocity ductwork shall be constructed to SMACNA 2" WG pressure class standards.
- B. Low velocity ductwork shall consist of outdoor intake ducts, supply ducts, exhaust ducts, transfer ducts, relief air ducts, and return ducts.

- C. Low velocity ductwork shall be constructed and installed in strict accordance with the recommendations and details of SMACNA (Sheet Metal and Air Conditioning Contractors' National Association, Inc., 8224 Old Courthouse Road, Tysons Corner, Vienna, Virginia 22180), **except where these Specifications exceed SMACNA requirements.**
- D. Low velocity ductwork shall be neatly built, rigidly braced with structural shapes to prevent vibration.
- E. Ductwork shall be constructed of galvanized sheet steel conforming to ASTM A527 or aluminum conforming to Aluminum Association Standards Designation #3003 H14, except as otherwise specified.
- F. Miscellaneous transitions, shapes and accessories may not have been indicated on the drawings due to the scale, however, the Contractor shall install the necessary sheet metal accessories to complete the systems.
- G. Special care shall be exercised to provide tight fitting, well fabricated well braced ductwork systems.
- H. Adjustment mechanisms, controls and dampers of each kind must be accessible.
- I. Drive slip joints shall not be used for joint connections unless the Contractor thoroughly tapes each joint with 3M or approved equal 4" wide vinyl impregnated cloth duct tape with adhesive back. Two 2" wide overlapped tapes may be used in lieu of 4" wide tape.
- J. Taped drive slip joints may be used on ducts up to and including 18" only.
- K. Rectangular low velocity ductwork shall be constructed with the sheetmetal thickness, joints, and bracing as indicated in the following table:

Steel Gauge	Aluminum Thickness	Maximum Size, Inches	Type of Transverse Joint Connections	Bracing
24	.020"	Up to 12	Plain S Slip, Pocket Lock or Bar Slips on 8'-0" Centers	None
24	.025"	13 to 18	Plain S Slip, Pocket Lock or Bar Slips on 8'-0" Centers	None

- L. The thickness of low velocity rectangular ductwork shall be no less than 24-gauge.
- M. Exposed ductwork shall be one (1) gauge heavier than that listed in the table above or as indicated on the drawings.
- N. Round low velocity ductwork shall be fabricated of galvanized steel with lock type spiral seams in accordance with SMACNA details and steel gauge thickness as listed in the SMACNA Manual, but not less than 26-gauge thickness. Round low velocity ductwork shall be as manufactured by United Sheet Metal, Semco, Hranec SMI, or approved equal.
- O. Round ductwork fittings shall be pressed or welded.
- P. Joints in ductwork shall be airtight and shall be constructed in accordance with SMACNA recommendations, except where SMACNA recommendations are exceeded by these Specifications.
- Q. Ductwork shall be supported by hanger straps, angles, rods, or bands, attached, sized and spaced in accordance with the SMACNA duct construction standards. Standard sheet metal practices listed and shown in the SMACNA "Duct Manual" shall apply to work to be performed.
- R. Longitudinal seam round ductwork will not be accepted.
- S. "Snap Lock" round ductwork will not be accepted.
- T. Adjustable elbows or fittings will not be accepted.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install ductwork per SMACNA Standards.

- B. The ends of ductwork and associated equipment shall be capped plugged, or adequately sealed at fabrication, during shipping, during storage at the site and as construction proceeds to prevent the entrance of dust, dirt, and other foreign matter. Open ends on installed duct work shall be capped, plugged or adequately sealed to prevent the entrance of dust, dirt, and other foreign matter.
- C. Ductwork, regardless of function or pressure class, shall be sealed air tight from fan or unit connections up to and including the register, grille, or diffuser collar. Ductwork joints shall be sealed in their entirety.
- D. Shape and location of ducts may be changed to suit building conditions, but area must be maintained.
- E. Immediately notify the Engineer of changes to ductwork sizes from that indicated on the plans.

3.02 DUCT PENETRATIONS OF FLOORS AND WALLS

- A. Where vertical sheet metal ducts pass through floors or masonry construction, supporting angles shall be rigidly bolted to the floor.
- B. The horizontal leg of the angle shall be of sufficient width to provide adequate bearing surface for the support of the respective duct.
- C. In each case, the supporting angle shall be placed on four sides of the duct.
- D. Where ductwork is exposed (not enclosed in masonry), a 2" high concrete curb shall be completely formed around the sides of the floor opening to prevent water dripping to the ceiling below.
- E. Space between ductwork and wall or floor opening shall be filled with Dow Corning 3 6548 RTV sealant, or approved equal, to prevent the passage of flame and smoke.
- F. Where horizontal ducts pass through masonry wall construction, additionally provide sheet metal angles or flanges on each side of wall to completely close opening.
- G. Seal openings through walls of air plenum spaces and relief air shafts, where ducts, are installed under this Contract to assure airtight plenum spaces. Coordinate this work with contractors of other trades.

3.03 DUCTWORK INSTALLATION INSPECTION

- A. When ductwork serving a designated room, area, floor, or phase is completed, the Contractor shall notify the Architect, Engineer or Owner's representative to permit inspection of the ductwork and associated accessories prior to the installation of ceilings.
- B. The Contractor shall seal, repair, modify, or replace ductwork which is found during the inspection to not meet the requirements of the plans and specifications.
- C. If ceilings are installed prior to the ductwork inspection, the Contractor shall be responsible for subsequent repairs to general construction, and repairs, modifications, or replacements of ductwork made necessary by Testing, Adjusting, and Balancing results, significant leakage, or constrictions in the ductwork.

3.04 UNACCEPTABLE HANGER AND SUPPORT INSTALLATIONS

- A. It is unacceptable to support any pipe(s) or duct(s) from other pipe(s) or duct(s).
- B. It is unacceptable for this Contractor to support his work from the hangers of other trades. Each trade shall install its own hangers.
- C. Unacceptable hanger and support installations shall be corrected as directed by the Architect/Engineer at no cost to the Owner.
- D. It is unacceptable to attach supports to the building structure or concrete slabs using nails or a nail gun.
- E. Perforated steel strap and perforated steel angle are unacceptable supports for ductwork.

END OF SECTION

SECTION 233300 – DUCT ACCESSORIES**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. This Section includes the following:
 - 1. Backdraft dampers.
 - 2. Manual-volume dampers.
 - 3. Motor operated dampers.
 - 4. Turning vanes.
 - 5. Access doors in ducts
 - 6. Flexible connectors.

PART 2 - PRODUCTS**2.01 BACKDRAFT DAMPERS**

- A. Acceptable Manufacturers:
 - 1. Arrow United Industries, Inc. (Type 655)
 - 2. Air Balance Inc. (Model BS 55)
 - 3. Greenheck Fan Corp. (Series VBD-360)
 - 4. National Controlled Air (Series BD2/A2)
 - 5. Ruskin Manufacturing Co. (Series CBD6)
 - 6. Nailor
 - 7. Pottorff
- B. Backdraft dampers shall be factory made of minimum .050" extruded aluminum blades supported on aluminum or zinc plated steel rods, in nylon bearings, set in minimum .063" extruded aluminum frame.
- C. Blades shall be fitted with vinyl inserts on contact edges to prevent noise. Blades shall be 40" maximum length and 6" maximum individual width.
- D. Damper assembly shall be provided with an adjustable counter-balance device.
- E. Channel frame shall be fitted to duct, vent or wall opening and edges sealed airtight. Inside dimensions of channel frame shall not be less than the daylight opening of the grille so that frame is not visible with grille in place.
- F. Exhaust fans equipped with backdraft dampers shall be furnished with dampers conforming to the requirements of this specification, and shall be furnished with dampers full size of connecting collar.
- G. Backdraft dampers shall be provided in exhaust duct discharges and at exhaust fans to keep tramp air from entering ductwork or rooms.
- H. Where shown on the drawings, provide motor operated dampers in lieu of backdraft dampers.

2.02 VOLUME CONTROL DAMPERS

- A. Acceptable Manufacturers:
 - 1. Air Balance Inc. (Rectangular Model AC-2, Round Model AC-112)
 - 2. Arrow United Industries Inc. (Model 1770)
 - 3. Louvers and Dampers, Inc. (Rectangular Model VCD-400, Round Model CD-600)
 - 4. National Controlled Air (Rectangular Model SCD-57, Round Model SCD-RD-88)
 - 5. United McGill Corp. (Round Dampers, Model SRSVL)
 - 6. Nailor
 - 7. Pottorff

- B. The Contractor shall provide volume control dampers as indicated on the drawings.
- C. Rectangular control dampers shall be of the factory fabricated opposed blade, multi-louver type, controlled from a single point with an adjusting device.
- D. Install end bearings with a rubber gasket on the outside of ducts or frames to prevent air leakage around the damper shaft and for smooth operation.
- E. Dampers shall be mounted in heavy galvanized steel channel frames and shall have smooth acting linkage.
- F. Blades shall be not less than 18 gauge galvanized, die-formed steel. Adjusting devices shall have locking mechanisms and shall be accessible.
- G. Round volume control dampers shall be factory fabricated, single blade, center pivoted, constructed of galvanized sheet steel, controlled from a single point with an accessible adjusting device with locking mechanism.

2.03 TURNING VANES

- A. Acceptable Manufacturers:
 - 1. Aero-Dyne Sound Control Company, High Efficiency Profile, HEP (Basis of Design). Contact: www.aero-dyne.net PH: 800-522-2423
- B. Turning vanes shall be installed at each change in direction of square or rectangular, low and medium velocity supply air ductwork, particularly at mitered elbows where radius elbows are impractical, and shall be of sizes to suit ductwork.
- C. Turning vanes shall be installed in outdoor air intake, return or exhaust ducts only where specifically shown or noted on the drawings.
- D. Turning vanes shall be an engineered, true airfoil design with smoothly rounded entry nose and extended trailing edge for low-pressure drop, anti-dirt, and positive fastening.
- E. Generated sound power level shall not exceed 54 decibels in band 4 at 2,000 FPM-duct 24 x24.
- F. Fabricate assemblies with the Aero-Dyne Side Rail support system. Install vanes on design centers of 2.4 inches across the full diagonal dimension of the elbow. Tabbed or slotted dimple fasteners are not acceptable.
- G. Submittals are required; proposed substitution shall include independent performance test data for pressure loss and generated sound power levels.

2.04 ACCESS DOORS IN DUCTS

- A. Furnish and install access doors and frames to permit inspection, operation and maintenance of devices concealed behind the sheetmetal work.
- B. Provide duct access doors of insulated double panel construction, not less than 20 gauge, galvanized steel.
- C. Where ducts are uninsulated or are not lined, insulation in access doors may be omitted.
- D. Provide access doors with sponge rubber gaskets around their entire perimeter.
- E. Hang access doors in ductwork in separate frames on heavy flat hinges. Provide "Ventlok No. 100" cast zinc latches.
- F. Where space conditions preclude the use of hinges, provide a minimum of 4 heavy window type latches.
- G. Provide duct access doors not smaller than 18" x 18". Provide ducts smaller than 18" in width with access doors two inches less in width than the width of the duct. Minimum dimension of one side to be 18".

2.05 FLEXIBLE CONNECTORS

- A. Acceptable Manufacturers:
 - 1. Ventfab
 - 2. Durodyne
 - 3. Approved equal
- B. Connections between motor operated equipment and ductwork shall be made through fire resistant canvas throats.

- C. Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel.
- D. Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
 - 1. Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
 - 2. Minimum Weight: 26 oz./sq. yd.
 - 3. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible".
- B. Volume control dampers shall be installed on each supply, return, and general exhaust duct branch serving a diffuser, grille, or register regardless of whether they are indicated on the drawings or not.
- C. Volume control dampers shall be placed in the ductwork sufficiently distant from diffusers, grilles, and registers to prevent the transmission of noise from the dampers through diffusers, grilles or registers.
- D. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.
 - 1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
 - 2. Install access panels on side of duct where adequate clearance is available.
- E. Label access doors according to Division 23 Section "Mechanical Identification."

3.02 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

END OF SECTION

SECTION 233423 –EXHAUST FANS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SCOPE

- A. The fans for the various HVAC systems shall be as hereinafter described in this section.

PART 2 - PRODUCTS**2.01 ROOF DOWNBLAST CENTRIFUGAL EXHAUST FANS – DIRECT DRIVE**

- A. Acceptable Manufacturers:
1. Greenheck Model G (Basis of Design)
 2. Twin City
 3. Loren Cook
- B. General Description:
1. Downblast fan shall be for roof mounted applications.
 2. Performance capabilities: Refer to the schedule on the drawings.
 3. Maximum continuous operating temperature is 180 Fahrenheit (82.2 Celsius).
 4. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.
- C. Wheel:
1. Constructed of aluminum.
 2. Non-overloading, backward inclined centrifugal.
 3. Statically and dynamically balanced in accordance with AMCA Standard 204-05.
 4. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.
- D. Motors:
1. Electronically Commutated Motor
 - a. Motor enclosures: Open type
 - b. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable.
 - c. Motors shall be permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 - d. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor.
 - e. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
 - f. Motor shall be a minimum of 85% efficient at all speeds.
- E. Housing:
1. Motor cover, shroud, curb cap, and lower wind band shall be constructed of heavy gauge aluminum.
 2. Shroud shall have an integral rolled bead for extra strength.
 3. Shroud shall be drawn from a disc and direct air downward.
 4. Lower wind band shall have a formed edge for added strength.
 5. Motor cover shall be drawn from a disc.
 6. All housing components shall have final thicknesses equal to or greater than preformed thickness.
 7. Curb cap shall have pre-punched mounting holes to ensure correct attachment.
 8. Rigid internal support structure.
 9. Leak proof.

- F. Housing Supports and Drive Frame:
 - 1. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.
- G. Vibration Isolation:
 - 1. Rubber isolators sized to match the weight of each fan.
- H. Disconnect Switches:
 - 1. NEMA rated: 4X (outdoors)
 - 2. Positive electrical shut-off.
 - 3. Wired from fan motor to junction box installed within motor compartment.
- I. Accessories:
 - 1. Birdscreen:
 - a. Material Type: Aluminum
 - 2. Dampers:
 - a. Type: Gravity backdraft balanced for minimal resistance to flow.
 - b. Galvanized frames with pre-punched mounting holes.
 - 3. Hinge Base:
 - a. Aluminum hinges
 - b. Hinges and restraint cables are mounted to a base (sleeve) to allow the fan to tilt away for access to wheel and ductwork for inspection and cleaning.
- J. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights the Owner may have under the Contract Documents.
 - 1. The warranty of this equipment is to be free from defects in material and workmanship for a period of one (1) year from start-up or eighteen (18) months from shipment, whichever occurs first. Any units or parts which prove defective during the warranty period, including the motor, shall be replaced.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install per manufacturers recommendations.

END OF SECTION

SECTION 233700 - DIFFUSERS, REGISTERS, AND GRILLES**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes
 - 1. Fixed face grilles

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

PART 2 - PRODUCTS**2.01 REGISTERS AND GRILLES**

- A. Fixed Face Register (Exhaust)
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anemostat Products
 - b. Krueger
 - c. Price Industries
 - d. Titus 350 FL
 - 2. Material: Aluminum
 - 3. Finish: Baked enamel, color selected by Architect
 - 4. Blade angle: 35°
 - 5. Blade spacing: 3/4"
 - 6. Damper Type: Adjustable opposed blade

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Install diffusers, registers, and grilles level, plumb and in accordance with manufacturer's instructions.
- B. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- C. Where diffusers are connected to ductwork or air valves with flexible duct, the diffuser shall be mounted to ceiling construction.
- D. Verify type of ceiling construction prior to submittal.
- E. Install all registers and diffusers after painting is completed.
- F. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement. Do not exceed 0.08" H₂O static pressure drop for registers and diffusers. Do not exceed 0.05" H₂O static pressure drop for grilles.
- G. Provide balancing dampers in duct take-off to each diffuser, register and grille regardless of

3.02 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 233713 – GAS-FIRED INFRARED RADIANT HEATERS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
- B. Gas-fired low-intensity infrared radiant tube heating systems.
- C. Suspension systems and mounting hardware.
- D. Reflectors, radiant tubes, burners, controls, and accessories.
- E. Thermostat interface and control wiring requirements.

1.02 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's catalog sheets.
 - 2. Performance data.
 - 3. Installation instructions.
 - 4. Clearance-to-combustibles requirements.
- B. Shop Drawings:
 - 1. Heater locations.
 - 2. Mounting heights.
 - 3. Suspension details.
 - 4. Gas and electrical connection requirements.
- C. Operation and Maintenance Manuals.
- D. Warranty documentation.

1.03 QUALITY ASSURANCE

- A. Manufacturer shall have a minimum of five years experience manufacturing gas-fired infrared heating equipment.
- B. Equipment shall be listed and labeled by CSA or equivalent nationally recognized testing agency.
- C. Installation shall comply with manufacturer's instructions and applicable codes.

1.04 WARRANTY

- A. Provide manufacturer's standard warranty.
- B. Minimum:
 - 1. Burner assembly: Five (5) years.
 - 2. Radiant tubes: Ten (10) years.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Product
 - 1. AmbiRad VPLUS80 or approved equal

2.02 GAS-FIRED INFRARED HEATER

- A. Type:
 - 1. Low-intensity, gas-fired, forced-draft infrared radiant tube heater.
- B. Configuration:
 - 1. Linear straight-tube arrangement.
 - 2. Overall heated tube length: 20 feet nominal.
 - 3. Single burner, positive-pressure combustion system.

- C. Performance Requirements:
 - 1. Input Capacity: 80,000 BTUH.
 - 2. Fuel: Natural Gas or Propane as scheduled.
 - 3. Thermal efficiency: Manufacturer's standard certified performance.
 - 4. Suitable for commercial and industrial indoor heating applications.
- D. Burner Assembly:
 - 1. Forced-draft combustion blower.
 - 2. Direct spark electronic ignition.
 - 3. Automatic flame supervision.
 - 4. Air-proving pressure switch.
 - 5. Integrated ignition control module.
 - 6. Enclosed burner/control housing.
- E. Radiant Tubes:
 - 1. Calorized or aluminized combustion chamber tube.
 - 2. Steel radiant emitter tubes.
 - 3. Factory-engineered tube coupling system.
 - 4. Internal turbulators as required by manufacturer.
- F. Reflectors:
 - 1. Bright aluminum reflectors.
 - 2. Minimum 0.024-inch aluminum construction.
 - 3. Reflector overlap and support clips per manufacturer.
- G. Controls:
 - 1. 24-volt thermostat interface.
 - 2. Single-stage operation.
 - 3. Safety lockout upon ignition failure.
 - 4. Manual reset after repeated ignition failure.
 - 5. Compatible with BAS/DDC dry-contact control.
- H. Electrical Requirements:
 - 1. 120 VAC.
 - 2. Single phase.
 - 3. 60 Hz.

2.03 ACCESSORIES

- A. Suspension hardware.
- B. Flexible gas connector.
- C. Manual gas shutoff valve.
- D. Vent kit where vented installation is required.
- E. Outside combustion air kit where indicated.
- F. Reflector side shields where required.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Suspend heater level and aligned with design drawings.
- C. Maintain all published clearances to combustibles.
- D. Install gas piping and flexible connector in accordance with applicable fuel gas codes.
- E. Install electrical connections in accordance with NEC requirements.
- F. Vent heaters where indicated on drawings.
- G. Provide combustion air connections where specified.

3.02 FIELD QUALITY CONTROL

- A. Verify gas pressure and combustion settings.
- B. Confirm proper ignition and flame stability.
- C. Test all safety devices.
- D. Demonstrate proper operation to Owner.

3.03 ADJUSTING AND CLEANING

- A. Adjust burner for proper operation.
- B. Remove installation debris.
- C. Clean reflector surfaces.

3.04 DEMONSTRATION

- A. Instruct Owner's personnel in operation and maintenance procedures.

END OF SECTION

SECTION 238116 – AIR FURNACE AND SPLIT-SYSTEM AIR CONDITIONING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Indoor gas-fired warm air furnace.
 - 2. Outdoor air-cooled condensing unit.
 - 3. Refrigerant piping and accessories.
 - 4. Thermostat and control wiring.
 - 5. Filter assembly.
 - 6. Condensate drainage system.
 - 7. Equipment supports and pads.
 - 8. Start-up and testing.
- B. System Description:
 - 1. Factory-matched split-system air conditioning and gas heating system.
 - 2. Cooling Capacity: Nominal 3 tons (36,000 BTUH).
 - 3. Cooling Efficiency: Minimum 14 SEER.
 - 4. Heating Efficiency: Minimum 80% AFUE.
 - 5. Refrigerant: R-32 or manufacturer's current approved refrigerant complying with applicable regulations.

1.02 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's literature for furnace and condensing unit.
 - 2. Performance data indicating capacities and efficiencies.
 - 3. Dimensions, weights, electrical requirements, and service clearances.
- B. Shop Drawings:
 - 1. Equipment layout.
 - 2. Refrigerant piping routing.
 - 3. Condensate piping routing.
 - 4. Electrical connections.
- C. Closeout Submittals:
 - 1. Operation and Maintenance Manuals.
 - 2. Warranty documentation.
 - 3. Start-up reports.

1.03 QUALITY ASSURANCE

- A. Equipment shall be listed and labeled by a nationally recognized testing laboratory.
- B. Equipment shall be AHRI certified.
- C. Installation shall be performed by qualified HVAC technicians experienced with split-system installations.

1.04 WARRANTY

- A. Manufacturer's standard warranty.
- B. Minimum Warranty:
 - 1. Compressor: 5 years.
 - 2. Heat Exchanger: 10 years.
 - 3. Parts: 1 year.

PART 2 - PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS**

- A. Subject to compliance with specifications:
 - 1. Daikin
 - 2. Carrier
 - 3. Trane

2.02 GAS-FIRED FURNACE

- A. Configuration:
 - 1. Horizontal. Factory-assembled and tested.
- B. Performance:
 - 1. Nominal Airflow Capacity: Suitable for 3-ton cooling system.
 - 2. AFUE: Minimum 80%.
- C. Construction:
 - 1. Heavy-gauge steel cabinet.
 - 2. Corrosion-resistant finish.
 - 3. Insulated blower compartment.
- D. Heat Exchanger:
 - 1. Aluminized steel or stainless steel.
 - 2. Factory-tested.
- E. Blower Assembly:
 - 1. Direct-drive blower motor.
 - 2. Multi-speed or ECM motor.
- F. Controls:
 - 1. Integrated furnace control board.
 - 2. Electronic ignition.
 - 3. Safety limit controls.
 - 4. Flame sensor.
- G. Filter:
 - 1. Disposable filter, minimum 1-inch thick.
 - 2. MERV 8 minimum unless otherwise indicated.

2.03 SPLIT-SYSTEM CONDENSING UNIT

- A. Performance:
 - 1. Nominal Cooling Capacity: 3 tons (36,000 BTUH).
 - 2. Seasonal Energy Efficiency Ratio (SEER): Minimum 14.
 - 3. Factory matched with indoor coil and furnace.
- B. Construction:
 - 1. Galvanized steel cabinet.
 - 2. Powder-coated finish.
 - 3. Weather-resistant construction.
- C. Compressor:
 - 1. Hermetic scroll compressor.
 - 2. Internal overload protection.
- D. Condenser Fan:
 - 1. Direct-drive motor.
 - 2. Permanently lubricated bearings.
- E. Refrigerant Controls:
 - 1. Factory-installed service valves.
 - 2. Refrigerant charge per manufacturer requirements.

2.04 EVAPORATOR COIL

- A. Factory-matched evaporator coil.
- B. Refrigeration-grade copper tubing with aluminum fins.
- C. Sloped condensate drain pan.
- D. AHRI-certified match with furnace and condensing unit.

2.05 THERMOSTAT

- A. Digital programmable thermostat.
- B. Heating and cooling control.
- C. Low-voltage operation.

2.06 CONDENSATE DRAINAGE

- A. Schedule 40 PVC piping.
- B. Trapped drain connection.
- C. Auxiliary drain pan where required.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify site conditions prior to installation.
- B. Do not install equipment until supporting construction is complete.

3.02 INSTALLATION

- A. Install equipment in accordance with manufacturer's instructions.
- B. Maintain required service clearances.
- C. Mount outdoor condensing unit on reinforced concrete pad.
- D. Install vibration isolation as recommended by manufacturer.
- E. Install refrigerant piping with proper supports and pitch.
- F. Install condensate drain with continuous slope.

3.03 FIELD QUALITY CONTROL

- A. Pressure test refrigerant piping.
- B. Evacuate system to manufacturer requirements before charging.
- C. Verify airflow and refrigerant charge.
- D. Test all safety controls.
- E. Verify thermostat operation.

3.04 START-UP

- A. Manufacturer's recommended start-up procedures shall be followed.
- B. Record operating pressures, temperatures, and amperages.
- C. Adjust blower speed to achieve required airflow.

3.05 DEMONSTRATION

- A. Instruct Owner in operation and maintenance procedures.
- B. Demonstrate filter replacement and thermostat programming.

END OF SECTION

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL**PART 1 - GENERAL****1.01 EXECUTION OF THE WORK**

- A. The scope of work shown on the drawings and in these specifications, Division 26, 27 and 28 are all a part of this contract and shall be included in the base bid unless otherwise noted.
- B. These Specifications call out certain duties of the Electrical Contractor and/or Subcontractors. They are not intended as a material list of items required by the Contract.
- C. These divisions of the Specifications cover the electrical systems of the project. It includes work performed by the electrical trades as well as trades not normally considered as electrical trades.
- D. Provide all items and work indicated on the Drawings and all items and work called for in the Specifications in accordance with the conditions of Contract (Division 1 General Requirements Documents). This includes all incidentals, equipment, appliances, services, hoisting, scaffolding, supports, tools, supervision, labor, consumable items, fees, licenses, etc., necessary to provide complete systems. Perform start-up and checkout on each item and system to verify the systems are fully operable.
- E. Comply with all provisions of the Contract Documents including Division 1, General Conditions, and Supplementary General Conditions of the Specifications.
- F. Certain terms such as "shall, provide, install, complete, start up" are not used in some parts of these Specifications. This does not indicate that the items shall be less than completely installed or that systems shall be less than complete.
- G. Examine and compare the Electrical Drawings and Specifications with the Drawings and Specifications of other trades, and report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the work. At time of bid the most stringent requirements must be included in said bid. Install and coordinate the electrical work in cooperation with other trades installing interrelated work. Before installation, make proper provisions to avoid interferences in a manner approved by the Engineer. All changes required in the work of the Contractor caused by neglect shall be corrected at the expense of the Contractor.
- H. It is the intent of the drawings and specifications to provide a complete workable system ready for the Owner's operation. These specifications are equipment and performance specifications. Items described or called out in the specification but not shown on the drawings are considered to be part of the project. Any item not specifically shown on the drawings or called for in the specifications, but normally required to conform to the intent are to be considered a part of the contract. Installation of the equipment shall be in accordance with the N.E.C., manufacturer recommendation, and industry standards.
- I. All material furnished by the Contractor shall be new and unused (temporary lighting and power products are excluded) and free from defects. All materials used shall bear the Underwriters Laboratory, Inc label provided a standard has been established for the material in question.
- J. All products and materials to be new, clean, free of defects and free of damage and corrosion.
- K. No exclusion from, or limitation in, the symbolism used on the Drawings for electrical work or the languages used in the Specifications for electrical work shall be interpreted as a reason for omitting accessories necessary to complete any required system or item of equipment.
- L. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.
- M. Except for conduit, conduit fittings, outlet boxes, wire and cable, all items of equipment or material shall be the product of one manufacturer throughout. Multiple manufacturers will not be permitted.

1.02 COORDINATION OF THE WORK

- A. Certain materials will be provided by other trades. Examine the Contract Documents to ascertain these requirements.
- B. Carefully check space requirements with other trades and the physical confines of the area to ensure that all material can be installed in the spaces allotted thereto including finished suspended ceilings. Make modifications thereto as required and approved.
- C. Transmit to other trades all information required for work to be provided under their respective sections in ample time for installation.
- D. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that all trades have the information necessary so that they may properly install all the necessary connections and equipment. Identify all items of work that require access so that the ceiling trade will know where to install access doors and panels.
- E. Due to the type of the installation, a fixed sequence of operation is required to properly install the complete systems. Coordinate, project and schedule work with other trades in accordance with the construction sequence.
- F. The locations of lighting fixtures, outlets, panels and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.
- G. Exercise particular caution with reference to the location of panels, outlets, switches, etc., and have precise and definite locations approved by the Engineer before proceeding with the installation.
- H. The Drawings show only the general run of raceways and approximate location of outlets. Any significant changes in location of outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Engineer and shall receive approval before such alterations are made. All such modifications shall be made without additional cost to the Owner.
- I. Obtain from the Engineer in the field the location of such outlets or equipment not definitively located on the Drawings.
- J. Circuit "tags" in the form of arrows are used where shown to indicate the home runs of raceways to electrical distribution points. These tags show the circuits in each home run and the panel designation. Show the actual circuit numbers on the finished record tracing and on panel directory card. Where circuiting is not indicated, the Electrical Contractor must provide required circuiting in accordance with the loading indicated on the drawings and/or as directed.
- K. The Drawings generally do not indicate the exact number wires in each conduit for the branch circuit wiring of fixtures, and outlets, or the actual circuiting. Provide the correct wire size and quantity as required by the indicated circuiting and/or circuit numbers indicated and control wiring diagrams, if any, specified voltage drop or maximum distance limitations, and the applicable requirements of the NEC.
- L. Adjust locations of conduits, panels, equipment, pull boxes, fixtures, etc. to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each raceway prior to installation.
 - 1. Right of way: lines which pitch to have the right-of-way over those which do not pitch. For example: steam, condensate, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed to have right-of-way over lines whose elevations can be changed.
 - 2. Make offsets, transitions and changes in direction in raceways and as required to maintain proper head room in pitch of sloping lines whether or not indicated on the Drawings.

- M. Whenever the work is of sufficient complexity, prepare additional Detail Drawings to scale similar to that of the bidding Drawings, prepared on tracing medium of the same size as Contract Drawings. With these layouts, coordinate the work with the work of other trades. Such detailed work to be clearly identified on the Drawings as to the area to which it applies. Submit for review Drawings clearly showing the work and its relation to the work of other trades before commencing shop fabrication or erection in the field.
- N. Contractor shall furnish services of experienced Superintendent, who shall be in constant charge of all work, and who shall coordinate his work with the work of other trades. No work shall be installed before coordinating with other trades.

1.03 EXAMINATION OF SITE

- A. Prior to submitting of bids, the Contractor shall visit the site of the job and shall familiarize themselves with all conditions affecting the proposed installation and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph will in no way relieve the Contractor of performing all necessary work shown on the Drawings.

1.04 PROGRESS OF WORK

- A. The Contractor shall order the progress of his work so as to conform to the progress of the work of other trades and shall complete the entire installation as soon as the conditions of the building will permit. Any cost resulting from the defective or ill-timed work performed under this section shall be borne by the Contractor.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Ship and store all products and materials in a manner which will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain replacement or repair. Any such repairs shall be subject to review and acceptance of the Engineer.
- B. Delivery of Materials: Deliver materials (except bulk materials) in manufacturer's unopened container fully identified with manufacturer's name, trade name, type, class, grade, size and color.
- C. Storage of Materials, Equipment and Fixtures: Store materials suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. Store all items subject to moisture damage in dry, heated spaces.

1.06 EQUIPMENT ACCESSORIES

- A. Establish sizes and location of the various concrete bases required. Coordinate with General Contractor and provide all necessary anchor bolts together with templates for holding these bolts in position.
- B. Provide supports, hangers and auxiliary structural members required for support of the work.
- C. Furnish and set all sleeves for passage of raceways through structural, masonry and concrete walls and floors and elsewhere as will be required for the proper protection of each raceway and passing through building surfaces.
- D. Wall mounted equipment, total weight of 100 pounds or less, may be directly secured to wall by means of steel bolts. Maintain at least 1" air space between equipment and supporting wall. Groups or arrays of equipment, with total weight of more than 100 pounds, shall be mounted on adequately free standing sized steel angles, channels, or bars. Prefabricated steel channels providing a high degree of mounting flexibility, such as those manufactured by Kindorf, Globe-Strutt and Unistrut, may be used for mounting arrays of equipment.

1.07 CUTTING, PATCHING, ETC.

- A. The work shall be carefully laid out in advance. Where Cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of raceway, outlets or other equipment, the work shall be carefully done. Any damage to the building, piping, equipment or defaced finish plaster, woodwork, metalwork, etc. shall be repaired by skilled mechanics of the trades involved at no additional cost to the Owner.
- B. The Contractor shall do no cutting, channeling, chasing or drilling of unfinished masonry, tile, etc., unless he first obtains permission from the Engineer. If permission is granted, the Contractor shall perform this work in a manner approved by the Engineer.
- C. Where conduits, outlet, junction, or pullboxes are mounted on a painted surface, or a surface to be painted, they shall be painted to match the surface. Whenever support channels are cut, the bare metal shall be cold galvanized.
- D. Slots, chases, openings and recesses through floors, walls, ceilings, and roofs will be provided by the various trades in their respective materials. The trade requiring them to properly locate such openings and be responsible for any cutting and patching caused by the neglect to do so.

1.08 NOMINAL VOLTAGES (UNLESS OTHERWISE NOTED)

- A. Primary distribution: 277/480 volt, 3 phase, 4 wire.
- B. Secondary Distribution: 120/208 volt, 3 phase, 4 wire.

1.09 MOUNTING HEIGHTS

- A. Unless otherwise noted or required because of special conditions, locate outlets as follows:
 - 1. Heights listed are from finished floor to center of device. Verify exact locations with the Engineer before installation.
 - a. Wall switch outlets.....40"
 - b. Bracket outlets 7'- 0" to bottom
 - c. Convenience outlets (general) 18"
 - d. Convenience outlets (mechanical areas).....4' - 0"
 - e. Panelboard and distribution cabinet to top 6' - 6"
 - f. Fire alarm audio unit Lower of 80" AFF or 6" below ceiling
 - g. Fire alarm visual unit..... 80" to bottom or 96" to top AFF
 - h. Fire alarm stations.....40" to top
 - i. Desk telephone outlets 18"
 - j. Wall telephone outlets.....4' - 9"
 - k. Desk intercommunication outlets 1' - 6"
 - l. Signal bells below ceiling 1' - 0"
 - m. Clock outlets below ceiling..... 1' - 0"
 - n. Chimes below ceiling 1' - 0"
 - o. Television outlets 1' - 6"
 - p. Pushbuttons 4' - 8"
 - q. Loudspeakers (classrooms).....8' - 0"
 - r. Loudspeakers (corridors)..... 1' - 0"

1.10 CLEANING UP

- A. Contractor shall take care to avoid accumulation of debris, boxes, crates, etc. resulting from the installation of work. Contractor shall remove from the premises each day all debris, boxes, etc., and keep the premises clean, subject to the Architect's instructions, which shall be promptly carried out.
- B. Contractor shall clean all fixtures and equipment at the completion of the project.
- C. All switchboards, panelboards, wireway, trench ducts, cabinets, enclosures, etc. shall be thoroughly vacuumed clean prior to energizing equipment at the completion of the project. Equipment shall be opened for observation by the Architect as required.

1.11 WATERPROOFING

- A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, perform it prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings. Perform work so as to maintain any warranties currently in effect.
- B. If this Contractor penetrates any walls or surfaces after they have been waterproofed, this Contractor shall restore the waterproof integrity of that surface at the expense of this Contractor and as directed by the Architect.

1.12 PRODUCTS

- A. If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. Where noted in other sections of this specification, equipment has been specified for a specific performance and substitutions are not permitted. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of Shop Drawings where Shop Drawings are required or as

1.13 OMISSIONS FROM THE DRAWINGS

- A. Should a Bidder find discrepancies in or omissions from the drawings or specifications or be in doubt as to their meaning, he shall notify the Architect before submitting his proposal. The Architect will in turn, send written instructions to all Bidders. Neither the Architect nor the Owner will be responsible for oral instructions. If the Contractor fails to comply with this requirement, he shall accept the Engineer's interpretations as to the intended meaning of the drawings and specifications.

1.14 EXECUTION

- A. Follow manufacturer's instructions for installing, connecting, and adjusting all equipment. Provide one copy of such instructions to the Architect before installing any equipment. Provide a copy of such instructions at the equipment during any work on the equipment. Provide all special supports, connections, wiring, accessories, etc.
- B. Use mechanics skilled in their trade for all work.
- C. Clean all items before and after installation. Clean up all debris.
- D. Perform all tests required by local authorities in addition to tests specified herein, such as life safety systems.
- E. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, NEMA, ANSI or IEEE standards and as approved by local authorities having jurisdiction.
- F. Before commencing work, examine all adjoining, underlying, etc., work on which this work is in any way dependent for perfect workmanship and report any condition which prevents performance of first class work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.

1.15 VERIFICATION OF ELECTRICAL REQUIREMENTS FOR EQUIPMENT FURNISHED BY OTHERS

- A. Prior to the installation of wiring systems for any equipment furnished by others, this contractor shall verify that the electrical requirements of the equipment match those shown on the electrical drawings by examining the approved shop drawings of that equipment. Any discrepancies shall be immediately reported to the engineer.
- B. If the contractor fails to comply with this requirement, he shall be responsible for any additional costs incurred at no additional cost to the Owner.

1.16 PROTECTION OF BUILDING FIRE/SMOKE BARRIERS

- A. Passages of conduit through fire barriers and/or smoke barriers shall be protected as follows:
 - 1. The space between the penetrating item and the fire barrier and/or smoke barrier shall be filled with a material capable of maintaining the fire/smoke resistance of the barrier or be protected by an approved device designed for the specific purpose.
 - 2. Where the penetrating item uses a sleeve to penetrate the fire and/or smoke barrier the sleeve shall be solidly set in the fire/smoke barrier and the space between the item and the sleeve shall be filled as described above.
 - 3. Fire barriers shall include 1-hour, 2-hour, and 3-hour rated floors and walls. Refer to architectural plans for location of fire barriers and smoke barriers and provide protection required to maintain ratings in accordance with all codes.
 - 4. Approved fill material for fire barriers shall be packed mineral wool, with ASTM E-136 rating and 3M Fire Barrier caulk. Coordinate sealing of all openings with requirements of Division 7 of this specification.
 - 5. Perform work in accordance with the appropriate UL Ratings.
 - 6. Product Data: Provide manufacturer's specifications, recommendations and installation instructions for each application.

1.17 CODES AND FEES

- A. General: Comply with Codes in accordance with the Contract Documents.
- B. The electrical installation shall be in compliance with the requirements of OSHA, NEC and the rules, regulations and requirements of the power company supplying power to the building.
- C. The electrical installation shall comply fully with all township, county and state laws, ordinances and regulations applicable to electrical installations.
- D. All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE and UL.
- E. Should any change in Drawings or Specifications be required to comply with governmental regulations, the Contractor shall notify Architects prior to execution of the work. The work shall be carried out according to the requirements of such code in accordance with the instruction of the Architect and at no additional cost to the Owner.
- F. The local fees and permits and services of inspection authorities shall be obtained and paid for by the Contractor. The Contractor shall cooperate fully with local utility companies with respect to their services.
- G. Certificate of Inspection and approval shall be procured and paid for by this Contractor from an approved certified inspection agency.

1.18 GUARANTEE

- A. General: Provide a Guarantee in accordance with the Contract Documents.
- B. Submit a single guarantee stating that all portions of the work are in accordance with Contract requirements. Guarantee all work against faulty and improper material and workmanship for a period of one (1) year from date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are specified herein, such longer term to apply. Within 24 hours after notification, correct any deficiencies which occur during the guarantee period at no additional cost to Owner, all to the satisfaction of the Owner and Architect. Obtain similar guarantees from subcontractors, manufacturers, suppliers and subtrade specialists.

1.19 DISPOSAL

- A. All electrical items not designated by the Owner for his use to be properly disposed of according to local, state and Federal regulations.
- B. Items containing polychlorinated biphenyl (PCB) to be removed, transported and disposed of according to Federal Toxic Substances Control Act (TSCA). Contractor to submit certification that these items have been properly disposed.

1.20 EXCAVATION AND TRENCHING

- A. Provide excavation for the work. Excavate all material encountered to the depths indicated on the Drawings or required. Remove from the site excavated materials not required or suitable for backfill. Provide grading as may be necessary to prevent surface water from flowing into trenches or other excavations. Remove any water accumulating therein. Provide sheeting and shoring as may be necessary for the protection of the work and for the safety of personnel.
- B. Provide trenches of widths necessary for the proper execution of the work. Grade bottom of the trenches accurately to provide uniform bearing and support the work on undisturbed soil at every point along its entire length. Where rock excavations are required, excavate rock to a minimum overdepth of 4 inches below the trench depths indicated on the Drawings or required. Backfill overdepths in the rock excavation and unauthorized overdepths with loose, granular, moist earth, thoroughly machine tamped to a compaction level as specified by the Engineer. Whenever unstable soil incapable of properly supporting the work is encountered in the bottom of the trench as determined by the Engineer, remove soil to a depth required and backfill the trench to the proper grade with coarse sand, fine gravel or other suitable material.
 - 1. Primary electric service: 4 feet (minimum).
 - 2. Secondary electric service: 2 feet (minimum).
 - 3. Telephone service: 2 feet (minimum).

1.21 BACKFILLING OF TRENCHES

- A. Do not backfill trenches until all required tests have been performed and the installation observed by the Engineer. Comply with the requirements of other sections of these Specifications. Deposit backfill in 6 inch layers and thoroughly and carefully tamp until for work has a cover of not less than 1 foot. Backfill and tamp remainder of trench at 12 inch intervals until complete. Uniformly grade the finished surface. Install a 6 inch marking ribbon 12 inches below finished grade.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)****END OF SECTION**

SECTION 260500.10 – ABBREVIATIONS AND DEFINITIONS**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Utilize the following abbreviations and definitions for discernment within the Drawings and Specifications.
1. Abbreviations
 - a. NEC National Electrical Code
 - b. OSHA Occupational Safety and Health Act
 - c. ANSI American National Standards Institute
 - d. NFPA National Fire Protection Association
 - e. ASA American Standards Association
 - f. IEEE Institute of Electrical and Electronics Engineers
 - g. NEMA National Electrical Manufacturers Association
 - h. UL Underwriters' Laboratories, Inc.
 - i. IES Illuminating Engineering Society
 - j. ICEA Insulated Cable Engineers Association
 - k. ASTM American Society of Testing Materials
 - l. ETL Electrical Testing Laboratories, Inc.
 - m. CBM Certified Ballast Manufacturers
 - n. EIA Electronic Industries Association
 - o. OEM Original Equipment Manufacturer
 - p. ADA Americans with Disabilities Act
 2. Definitions
 - a. "PROVIDE" means to supply, purchase, transport, place, erect, connect, test and turn over to Owner, complete and ready for regular operation, the particular work referred to.
 - b. "INSTALL" means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation, the particular work referred to.
 - c. "FURNISH" means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories and all other items customarily required for the proper and complete application for the particular work referred to.
 - d. "WIRING" means the inclusion of all raceways fittings, conductors, connectors, tape, junction and outlet boxes, connections, splices, and all other items necessary and/or required in connection with such work.
 - e. "CONDUIT" means the inclusion of all fittings, hangers, supports, sleeves, etc.
 - f. "AS DIRECTED" means as directed by the Architect or his representative.
 - g. "CONCEALED" means embedded in masonry or other construction, installed behind wall furring or within double partitions or installed within hung ceilings.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)****END OF SECTION**

SECTION 260500.15 – WORK INCLUDED**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. General: Provide the work included in accordance with the Contract Documents.
- B. Provide all labor, materials, equipment, tools, appliances, auxiliaries, services, hoisting, scaffolding, support, supervisions, Project Record Documents, and perform all operations noted in the Documents. Perform all operations for the furnishing and installation of the complete electrical system, including, but not limited to, the work described hereinafter. The work shall meet or exceed the latest codes, regulations and requirements of the state and local community.
- C. The electrical work is shown schematically on the Drawings to indicate the general system arrangement and configuration. The work of this Division shall include coordination with the work of other Divisions of the Specifications and the Contract Documents so as to provide complete and operational systems capable of being readily operated and maintained, to the Owner's satisfaction.
- D. The work includes, but is not limited to the following:
 - 1. Alteration and additions to existing 5 KV distribution system. Installation of metal-clad medium voltage switchgear
 - 2. Installation of metal-clad low voltage switchgear
 - 3. Installation of 5 KV feeders
 - 4. Alterations and additions to existing power distribution system
 - 5. Installation of 5 KV emergency generators and paralleling switchgear
 - 6. Emergency lighting system
 - 7. Installation of an uninterruptible power supply (UPS) system
 - 8. Alteration and addition to exterior site lighting
 - 9. Alterations and addition to existing building facilities
 - 10. Lighting system
 - 11. Power distribution system
 - 12. Hospital paging system speakers and wiring
 - 13. Telecommunication system
 - 14. Fire alarm system
 - 15. Nurse call system
 - 16. Grounding system
 - 17. Equipotential ground system
 - 18. Connection to owner furnished equipment
 - 19. Connection to HVAC and plumbing equipment
 - 20. Transformers
 - 21. Conduit and wire for operating room equipment
 - 22. Cable tray
 - 23. Automatic transfer switches with bypass and generator start circuit wiring
 - 24. CATV raceway system
 - 25. Monitoring system
 - 26. Security system
 - 27. Isolation panels
 - 28. Lightning protection system
 - 29. Clock system

- 30. Television system
- 31. UPS system
- 32. Short circuit/coordination/flash hazard study
- 33. Snow melting

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

260500.17 – REVIEWS AND ACCEPTANCES**PART 1 - GENERAL****1.01 SUBSTITUTION OF MATERIALS OR EQUIPMENT**

- A. Materials specified by name or catalog number are base bid items and substitutions are not permitted. If the contractor elects to submit a substitution, it shall be listed on their base bid as an addition or deletion to their base bid.

1.02 SHOP DRAWINGS

- A. Prepare and submit detailed shop drawings for materials, systems and equipment as listed herein, including locations and sizes of all openings in floor decks, walls and floors.
- B. The work described in any shop drawing submission shall be carefully checked for all clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and proper condition with all trades on the job. Each submitted shop drawing shall include a certification that all related job conditions have been checked and that no conflict exists.
- C. All drawings shall be submitted sufficiently in advance of final requirements to allow ample time for checking and resubmittal as may be required. All submittals shall be complete and contain all required and detailed information.
- D. Acceptance of any submitted data or shop drawings for material, equipment apparatus, devices, arrangement and layout shall not relieve Contractor from responsibility of furnishing same of proper dimensions and weight, capacities, sizes, quantity, quality and installation details to efficiently perform the requirements and intent of the contract. Such acceptance shall not relieve contractor from responsibility for errors, omissions or inadequacies of any sort on submitted data or shop drawings.
- E. Each shop drawing shall contain job title and reference to the applicable drawing and specification article.

1.03 SHOP DRAWING SUBMITTALS

- A. Certified Submittals
 - 1. All electrical materials, devices, appliances and equipment shall be labeled and listed by a certified testing laboratory or agency.
- B. Submit for the Architect's approval shop drawings of the following and any other shop drawings requested:
 - 1. Panelboards and switchboard
 - 2. Cabinets
 - 3. Lighting fixtures
 - 4. Fire alarm
 - 5. Safety switches
 - 6. Surface vinyl raceway
 - 7. Wiring devices
 - 8. Generator and automatic transfer switches
 - 9. Lighting contactors
 - 10. Switchboard
 - 11. Multi-purpose room sound system
 - 12. Surge protective devices
 - 13. Building communication system
 - 14. Three phase harmonic suppression system
 - 15. Cat 6 cabling system and devices
 - 16. Television distribution system and devices
 - 17. Security systems and devices
 - 18. Uninterruptible power system

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 260500.19 - MAINTENANCE MANUALS**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. General: Provide maintenance manuals in accordance with the Contract Documents.

1.02 SUBMITTALS

- A. Provide three (3) hard copies or (3) digital copies of each manual.
- B. Hard copies to be 8-1/2 inches x 11 inches size in hard back 3-ring loose-leaf binders. Use more than one volume if required; do not overfill binders.
- C. Digital copies shall be provided on individual flash disk drives (USB type) and attached to a large placard.
- D. Submit one (1) copy to Architect. After review and acceptance, assemble other copies.
- E. Manuals to be completed and in Owner's hands prior to turning building over to Owner and at least 10 days prior to instruction to operating personnel.

PART 2 - PRODUCTS**2.01 MANUFACTURERS' LITERATURE**

- A. General: Provide manufacturers' literature on all items of equipment and components as regularly published by the respective manufacturers for proper preventative and comprehensive maintenance.

PART 3 - EXECUTION**3.01 PROVIDE MAINTENANCE MANUALS INCLUDING BUT NOT LIMITED TO THE FOLLOWING:**

- A. Alphabetical list of all system components, with the name, address, and 24-hour phone number of the company responsible for servicing each item during the first year of operation.
- B. Operating instructions for complete system including:
 - 1. Normal starting, operating, and shut-down.
 - 2. Emergency procedures for fire or failure of major equipment.
- C. Maintenance instructions including:
 - 1. Proper lubricants and lubricating instructions for each piece of equipment, and date when lubricated.
 - 2. This shall be a separate list in addition to manufacturers' data.
 - 3. Necessary cleaning, replacement and/or adjustment schedule.
- D. Manufacturers' data on each piece of equipment including:
 - 1. Installation instructions.
 - 2. Drawings and specifications.
 - 3. Parts list, including recommended items to be stocked.
 - 4. Complete wiring diagrams.
 - 5. Marked or changed prints locating all concealed parts and all variations from the original system design.
 - 6. Test and inspection certificates.

END OF SECTION

SECTION 260500.22 – EQUIPMENT WIRING**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. General: Provide final connections to equipment and coordinate same in accordance with the Contract Documents.
- B. Equipment to receive final connections shall include, but not be limited to the following:
 - 1. Mechanical equipment
 - 2. Appliances
 - 3. Miscellaneous equipment
 - 4. Owner furnished equipment
 - 5. Automatic doors and controls

1.02 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
 - 1. American National Standard Safety Code for Elevators, Dumbwaiters and Moving Walks (ANSI A17.2).
 - 2. The National Electric Code (NFPA 70)

1.03 EXAMINATION OF DOCUMENTS

- A. Prior to the submitting of bids, the Contractor shall familiarize himself with all conditions affecting the proposed installation of equipment requiring electrical connections and shall make provisions as to the cost thereof. Failure to comply with the intent of this paragraph shall in no way relieve the Contractor of performing all necessary work required for final electrical connections and equipment.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION****3.01 MECHANICAL EQUIPMENT**

- A. All power wiring and connections for all motors including starters, controllers, and breakers as indicated on the drawings and the riser diagrams shall be furnished and installed under this section of the specifications.
- B. Motors shall be connected in a neat and skillful manner. Ones delivered with terminal boxes that are inadequate shall be equipped with special boxes that suit the conditions.
- C. In general, rigid conduit or tubing shall be used, but motors that require movement or ones that would transmit vibration to conduit shall be wired with liquid tight flexible steel conduit not over 18" long.
- D. All motors shall be grounded with a green covered ground wire run inside the conduit and connected to motor frame on one end and to grounding system on the other end.
- E. Motors and their starters not located in the motor control center are only approximately located on the drawings and the Contractor shall allow for the relocation that developed conditions may demand.
- F. The location of motors, starters and control equipment and the arrangement to be followed shall be determined on the job jointly by the Contractor whose equipment is involved, this Contractor and the Architect.
- G. Starting equipment shall be either wall mounted or free standing, as best suits conditions. If free standing, this Contractor shall make and install a suitable frame of structural steel to accommodate it.

- H. Furnish and install one motor snap switch of the proper size for disconnect of each single phase motor indicated on the drawings.
- I. All equipment furnished with a variable frequency drive (VFD) shall utilize VFD cable to the motor.

3.02 CONTROL WIRING

- A. Control wiring for HVAC and Plumbing equipment will be furnished and installed by Plumbing and HVAC Contractor as Specified in Divisions 22 and 23.
- B. All control wiring in Divisions 22 and 23 is the responsibility of the contractor who provides the particular equipment. Control wiring includes the providing of all required motor controls, relays, pilot devices, all related raceway systems, all related conductors and all final connections other than three phase power connections.
- C. For single phase equipment provided under HVAC and Plumbing Contracts, this Contractor shall provide single phase feeders and make final connection through the control device.
- D. All other control wiring required by other Divisions of the Specifications shall be furnished and installed by this Contractor. Unless specifically indicated on the drawings or specified hereinafter to the contrary, all control devices such as starters, pushbuttons, limit switches, etc., are furnished under other Divisions of the Specifications. This Contractor shall receive and store all electrical equipment to be installed by him. Conduit and layout and arrangement of control wiring shall be done by this Contractor.

3.03 EQUIPMENT CONNECTIONS

- A. This contractor shall make final connections to all electrical equipment. Coordinate with equipment supplier for size and location of all final connections. Contractor to match receptacle with plugs of equipment supplied by others.

END OF SECTION

SECTION 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Section, apply to this Section.

1.02 SUMMARY

- A. General: Provide 600 volt wire and cable in accordance with the Contract Documents.

1.03 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
 - 1. Underwriters Laboratory Standard No. UL 467, UL 486c
 - a. ASTM
 - b. IPECA
 - 2. Terminal Blocks
 - a. UL-1059

PART 2 - PRODUCTS**2.01 WIRE AND CABLE**

- A. General
 - 1. Provide wire with a minimum insulating rating of 600 volts, except for wire used in 50 volts or below applications for control of signal systems use 300 volt minimum or 600 volt where permitted to be incorporated with other wiring systems.
- B. Conductor
 - 1. Electrical grade, annealed copper fabricated in accordance with ASTM standards. Minimum size number 12 for branch circuits; number 14 for control wiring.
 - 2. The conductors shown on the drawings are copper, except as noted otherwise.
- C. Stranding and Number of Conductors
 - 1. Number 12 and number 10 solid.
 - 2. Cables larger than number 10, stranded in accordance with ASTM Class B stranding designations.
 - 3. Control wires stranded in accordance with ASTM Class B stranding designations.
 - 4. Cables, multi-conductor unless otherwise noted for low tension systems.
- D. Insulation
 - 1. Type THWN/THHN insulation suitable for use in wet locations up to 75 degrees Centigrade. Use for lighting, receptacle and motor circuits and for panel and equipment feeders.
 - 2. Type THHN – Flame retardant: Heat-resistant thermoplastic insulation, nylon jacket rated for 90 degrees Centigrade operation. Use for lighting branch circuit wiring installed and passing through the ballast channels of fluorescent fixtures, wiring in metal roofdecks in or near roof insulation, in attic or joist spaces, or in raceways exposed to the sun.
 - 3. Type XF – Crosslinked polyolefin insulated heat-resistant wire suitable for 150 degrees Centigrade operation. Use for fixture wiring or any wiring within 3 feet horizontally or 10 feet above any furnace, boiler or similar appliance.

- E. 2-Hour Fire Rated Wiring System (MI)
1. Cable shall be 2-hour rated, UL rated with copper sheath. Cable shall be factory assembled of one or more conductors insulated with highly compacted magnesium oxide insulation and enclosed in a seamless, liquid- and gas-tight continuous copper sheath.
 2. Conductors shall be solid, high electrical conductivity copper with cross section corresponding to the standard N.E.C. AWG sizes.
 3. Insulation shall be of highly compressed magnesium oxide that provided proper spacing for the conductors. Thickness of the insulation shall be at least 55 mils for all 600 volt power or control cables.
 4. Cable and installation shall comply with N.E.C. Article 332. Cables must be supported per manufacturers recommendations.
 5. Cable shall be Pentair System 1850 or approved equal. Provide shop drawings of cable and fittings.
- F. VFD Cabling
1. VFD cabling to be provided from output of each VFD to motor being controlled.
 2. VFD cabling to be a flexible, shielded cable utilizing XLPO insulation, PVC jacket, full size insulated ground and braid/foil shield with drain wire.
 3. VFD cable shall be equal to Houston Wire & Cable HW190A/HW190B.
- G. Color Coding
1. Provide consistent color coding of all feeders, sub feeders, motor circuits and the likes as follows:

120/208 Volts Code	277/480 Volts Code
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Orange
Phase C - Blue	Phase C - Yellow
Neutral - White	Neutral - Gray
Ground - Green	Ground - Green w/Yellow Stripe

2. Color code wiring for control systems installed in conjunction with mechanical and/or miscellaneous equipment in accordance with the wiring diagrams furnished with the equipment. Factory color code wire number 2 and smaller. Wire number 1 and larger may be color coded by color taping of the entire length of the exposed ends.

2.02 CONNECTORS

- A. Make connections, splices, taps and joints with solderless devices, mechanically and electrically secure. Protect exposed wires and connecting devices with electrical tape or insulation to provide not less than that of the conductor.
- B. Branch Circuit wires (Number 10 and smaller): Use any of the following types of terminals and connecting devices:
1. Hand Applied
 - a. Coiled tapered, spring wound devices with a conducting corrosion-resistant coating over the spring steel and a plastic cover and skirt providing full insulation for splice and wired ends. Screw connector on by hand.
 2. Tool Applied
 - a. Steel cap, with conduction and corrosion resistant metallic plating, open at both ends, fitted around the twisted ends of the wire and compressed or crimped by means of a special die designed for the purpose. Specifically fitted plastic or rubber insulating cover wrap over each connector.

2.03 ELECTRICAL TAPE

- A. Specifically designed for use as insulating tape.

2.04 LUBRICANT

- A. Use lubricant only where the possibility of damage to conductors exists. Use only a lubricant approved by the cable manufacturer and one which is inert to cable and raceways.

PART 3 - EXECUTION

3.01 WIRE AND CABLE

- A. Provide a complete system of conductors in raceway system. Mount wiring through a specified raceway, regardless of voltage application.
- B. Drawings do not indicate size of branch circuit wiring. For branch circuits whose length from panel to furthest outlet exceeds 100 feet for 120-volt circuits, use number 10 or larger.
- C. Do not install wire in incomplete conduit runs nor until after the concrete work and plastering is completed and moisture is swabbed from conduits. Eliminate splices wherever possible. Where necessary, splice in readily accessible pull, junction, or outlet.
- D. Provide cable supports for all vertical risers where required by code.
- E. Flashover or insulation value of joints to be equal to that of the conductor. Provide Underwriters Laboratories listed connectors rated at 600 volts for general use and 1,000 volts for use between ballasts and lamps or gaseous discharge fixtures.
- F. Use terminating fittings, connectors, etc., of a type suitable for the specified cable furnished. Make bends in cable at termination prior to installing compression device. Make fittings tight.
- G. Extend wire sizing for the entire length of a circuit, feeder, etc. unless specifically noted otherwise.
- H. Provide a separate neutral conductor for each branch circuit. In the event a common neutral conductor is used, such as in furniture systems, the circuit breaker in the panelboard must be common trip for each phase that uses one neutral conductor.

END OF SECTION

SECTION 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Section, apply to this Section.

1.02 SUMMARY

- A. General: Provide a low impedance grounding system in accordance with the Contract Documents.

1.03 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
 - 1. Underwriters Laboratory Standard No. UL 467
 - 2. ANSI C-1 1978

PART 2 - PRODUCTS**2.01 GENERAL**

- A. Furnish and install an electrical grounding system as indicated on the construction documents and as specified herein.
- B. Grounding systems shall be installed in accordance with the requirements of the local authorities, NEC Section 250, and subject to the approval of the Architect.
- C. All ground wires and bonding jumpers shall be stranded copper installed in conduit. All ground wires shall be without joints and splices over its entire length.

2.02 GROUNDING SYSTEMS

- A. The system neutral shall be grounded at the service entrance only, and kept isolated from grounding systems throughout the building.
- B. Each system of continuous metallic piping and ductwork shall be grounded in accordance with the requirements of the NEC Section 250.
- C. Metal conduits and portions of metallic piping and duct systems which are isolated by flexible connections, insulated coupling, etc., shall be bonded to the equipment ground with a flexible bonding jumper, or separate grounding conductor.
- D. All conduits, metal raceways, boxes, cabinets, etc., installed by this Contractor and all motors and equipment connected shall be properly bonded and grounded.
- E. In all feeders and branch circuits install a green colored ground wire to each panel, cabinet, receptacle, motor or piece of control equipment.
- F. The green ground wires shall be extended and connected to the ground bus in the panels or equipment enclosure. Neutral wiring system shall not be used for this purpose. Green ground wire shall be connected to all junction or pull boxes through which they pass and to all cabinet and panel enclosures.
- G. This ground wire shall be run in same conduit as phase and neutral wires feeding equipment, motor or receptacles and conduit size shall be increased if necessary. This conductor shall be installed whether or not shown on the drawings and shall be sized in accordance with NEC but shall not be smaller than #12 AWG. Motors shall be grounded by a grounding terminal in their connection box. Tie all ground wires together in panels and connect to ground bus in panel cabinet.
- H. All electrical equipment including lighting fixtures shall be grounded in the same manner as motors. All equipment shall be solidly grounded to the green covered wire and this Contractor shall furnish grounding lugs as required.

PART 3 - EXECUTION

3.01 GENERAL

- A. Grounding connections and splices shall be brazed molded exothermic welded, bolted clamp terminal or pressure-connector type. Bolted connections and pressure-connectors shall be used for connections to removable equipment. Brazed connections shall be made where noted on drawings.

END OF SECTION

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specification Section, apply to this Section.

1.02 SUMMARY

- A. Equipment shall be installed on hangers and supports as specified in this section of the specifications.

1.03 SUPPORTS

- A. Support work in accordance with the best industry practice and the following.
- B. Include supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets.
- C. Include supporting frames or racks for equipment, intended for vertical surface mounting, which is required in a free-standing position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members. They shall be rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Nothing, (including outlet, pull and junction boxes and fittings) shall depend on electric conduits, raceways, or cables for support, except that threaded hub type fittings having a gross volume not in excess of 100 cubic inches may be supported from heavy wall conduit, where the conduit in turn is securely supported from the structure within five inches of the fitting on two opposite sides.
- F. Nothing shall rest on, or depend for support on, suspended ceilings media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling).
- G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure.

1.04 FASTENINGS

- A. Fasten electric work to building structure in accordance with the best industry practice and the following:
- B. As a minimum procedure, where weight applied to the attachment points is 100 pounds or less, fasten to building elements of:
 - 1. Wood – with wood screws.
 - 2. Concrete and solid masonry – with bolts and expansion shields.
 - 3. Hollow Construction – with toggle bolts.
 - 4. Solid metal – with machine screws in tapped holes or with welded studs.
 - 5. Steel decking or subfloor – with fastenings as specified below for applied weights in excess of 100 pounds.

- C. As a minimum procedure, where weight applied to the attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following:
 - 1. At concrete slabs utilize 24" x 24" x 1/2" steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screen line, where no fill is to be applied.
 - 2. At steel decking or subfloor for all fastenings, utilize through bolts or threaded rods. The tops of bolts or rods shall be set at least one inch below the top fill screen line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or subfloor manufacturer produces specialty hangers to work with his decking or subfloor such hangers shall be utilized.
- D. Where weight applied to building attachments points exceeds 300 pounds, coordinate with and obtain approval of Architect and conform to the following:
 - 1. Utilize suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Utilize threaded rods or bolts to attach to bridging members.
- E. Floor mounted equipment shall not be held in place solely by its own dead weight. Include floor anchor fastenings in all cases.
- F. For items which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.

END OF SECTION

SECTION 260533 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. General: Provide raceways in accordance with the Contract Documents.

1.02 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
1. Rigid Conduit – RMC
 - a. UL Standard UL-6
 - b. ANSI C80-1
 - c. Federal Specification WW-C-581E
 2. Electrical Metallic Tubing – EMT
 - a. UL Standard UL-797
 - b. ANSI C80-3
 - c. Federal Specification WW-C-563
 3. Flexible Metal Conduit – FMC
 - a. UL Standard UL-1
 4. LiquidTight Flexible Metal Conduit – LFMC
 - a. UL Standard UL-360
 5. Rigid Non-Metallic Conduit – RNC
 - a. UL Standard UL-651
 - b. ANSI Standard C33.91
 - c. Federal Specifications GSA-FSS and W-C1094-A
 6. Wireways and Auxiliary Gutters
 - a. UL Standard UL-870
 7. Armored Steel Cable – AC HCF 90
 - a. UL Standard 1581
 - b. Federal Spec J-C-30B
 8. Metal Clad Cable – MC
 - a. UL Standard 1581
 - b. Federal Spec J-C-30B

PART 2 - PRODUCTS**2.01 RACEWAY TYPES**

- A. Rigid Steel Conduit – RMC
 1. Rigid steel conduit heavy wall galvanized.
- B. Electric Metallic Tubing – EMT
 1. Continuous, seamless tubing galvanized or sheradized on the exterior coated on the interior with a smooth hard finish of lacquer, varnish or enamel.
 2. All couplings, connectors, etc., used in conjunction with this raceway which are 2 inch in size and smaller shall be watertight compression type. EMT fittings shall be zinc plated steel. With conduits of 2-1/2 inch in size and larger, set screw type couplings are permitted.
- C. Flexible Metal Conduit – FMC
 1. Single strip, continuous, flexible interlocked double-wrapped steel, galvanized inside and outside forming smooth internal wiring channel.
 2. Maximum length: 6 feet.
 3. Each section of raceway must contain a bonding wire bonded at each end and sized as required. Provide connectors with insulating bushings.

- D. LiquidTight Flexible Metal Conduit – LFMC
 1. Same as flexible steel conduit except with tough, inert watertight plastic outer jacket.
 2. Cast malleable iron body and gland nut cadmium plated with one-piece brass grounding bushings which thread to interior of conduit. Spiral molded vinyl sealing ring between gland nut and busing and nylon insulated throat.
- E. Metal Clad Cable – MC
 1. Type MC cable shall be armored galvanized steel sheath cable with copper conductors and THHN 90 ° insulation. Furnish with insulated grounding conductor.
- F. Rigid Non-Metallic Conduit – RNC
 1. Composed of polyvinyl chloride suitable for 90° C.
 2. Raceway, fittings and cement must be produced by the same manufacturer who must have had a minimum of ten (10) years experience in manufacturing the products.
 3. Materials must have a tensile strength of 7,000 – 7,200 psi and compressive strength of 9,000 psi.
 4. All joints shall be solvent cemented in accordance with the recommendations of the manufacturer. Install expansion fittings per NEC.
- G. Wireways and Auxiliary Gutters
 1. Of sizes and shapes indicated on the Drawings and as required.
 2. Provide all necessary elbows, tees, connectors, adaptors, etc.
 3. Hinged cover secured with captive screws.
 4. Wire retainers not less than 12 inches on center.
- H. Duct Banks
 1. Provide duct banks as indicated on the Drawings.
 2. Reinforce duct banks with steel where such duct banks are positioned beneath roads and parking areas.
 3. Concrete to be minimum of 3,000 pounds per square inch.
 4. Provide rigid steel raceway across all excavated and backfilled ditches and for a length of 10 feet from building and manhole walls. Pitch conduit away from building at every point where duct bank enters the building or equipment.
 5. Support raceways installed in duct banks every 5 feet to assure correct alignment prior to placing concrete.
 6. Terminate raceways with flared bells to enable ease of pulling cable and to eliminate stress on the cable. Free bells and raceway terminations of burrs and rough edges.
 7. Provide concrete markers at grade where duct banks are stubbed out for future use.
 8. Install duct banks not less than 30 inches below grade. Install 6 inch marking ribbon 12 inches below grade.
 - a.

2.02 OUTLET, JUNCTION AND PULLBOXES

- A. Provide zinc-coated or cadmium-plated sheet steel outlet boxes not less than 4 inches octagonal or square, unless otherwise noted. Equip fixture outlet boxes with 3/8 inch no-bolt fixture studs where required. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Fit outlet boxes in finished ceilings or walls with appropriate covers, set flush with the finished surface. Where more than one switch or device is located at one point, use gang boxes and covers unless otherwise indicated. Sectional switch boxes or utility boxes will not be permitted. Provide Series "GW" (Steel City) tile box, or as accepted, or a 4 inch square box with tile ring in masonry walls which will not be plastered or furred. Where drywall material is utilized, provide plaster ring. Provide outlet boxes of the type and size suitable for the specific application. Where outlet boxes contain two or more 277 volt devices, or where devices occur of different applied voltages, or where normal and emergency devices occur in same box, provide suitable barrier.

- B. Construct junction or pullboxes not over 150 cubic inches in size as standard outlet boxes, and those over 150 cubic inches the same as "cabinets" with screw covers of the same gauge metal.
- C. Plug any open knockouts not utilized.
- D. Provide surface mounted outlet and junction boxes in indoor locations where exposed to moisture and outdoor locations of cast metal with threaded hubs.

PART 3 - EXECUTION

3.01 APPLICATION OF RACEWAYS

- A. The following applications must be adhered to except as otherwise required by Code. Raceway not conforming to this listing must be removed by this Contractor and replaced with the specified material at this Contractor's expense.

Raceway Types	Application
Rigid Conduit RMC	1. Where exposed on outside of building or subjected to exterior temperatures and humidity. 2. Where required by codes. 3. All circuits in excess of 600V.
Electrical Metallic Tubing EMT	Use in every instance except where another material is specified.
Flexible Metal Conduit – FMC	Use in dry areas for connections to lighting fixtures in hung ceilings, connections to equipment installed in removable panels of hung ceilings at all transformer or equipment raceway connections where sound and vibration isolation is required.
LiquidTight Flexible Metal Conduit - LFMC	Use in areas subject to moisture where flexible steel is unacceptable at connections to all motors, and all raised floor areas.
Rigid Non-Metallic Conduit – RNC	1. Schedule 40 – Where raceways are in slab in below grade levels, for raceway duct banks. 2. Schedule 80 – For underground raceways outside of the building which are not encased in concrete
Armored Cable – AC HFC-90	Use for branch circuit wiring above suspended ceiling or in metal stud walls. Cable shall not be run exposed. Home run wiring from panelboard to first outlet box shall be installed in conduit. AC cable not permitted for fire alarm wiring systems.
Metal-Clad Cable - MC	Use for branch circuit wiring above suspended ceilings or in metal stud walls. Cable shall not be run exposed. Home run wiring from panelboard to first outlet box shall be installed in conduit. MC cable not permitted for fire alarm wiring systems or emergency lighting.
Wireways and Auxiliary Gutters	Where indicated on the drawings and as otherwise specifically approved.

3.02 RACEWAY SYSTEMS IN GENERAL

- A. Provide raceways for all wiring systems unless noted otherwise. 277/480 volt wiring must be kept independent of 120/208 volt wiring. Where non-metallic raceways are utilized, provide sizes as required with the grounding conductor considered as an insulated additional conductor. Minimum size 3/4 inch for home runs and 1 inch minimum for power distribution. Wiring of each type and system must be installed in separate raceways.

- B. Install capped bushings on raceways as soon as installed and remove only when wires are pulled. Securely tie embedded raceway in place prior to embedment. Raceways installed below or in floor slabs must extend a minimum of 4 inches above the finished slab to the first connector. Lay out the work in advance to avoid excessive concentrations or multiple raceway runs.
- Locate raceways so that the strength of structural members is unaffected and they do not conflict with the services of other trades. Install 1 inch or larger raceways in or through structural members (beams, slabs, etc.) only when and in the manner accepted by the Architect. Draw up couplings and fittings full and tight. Protect threads from corrosion with one coat zinc chromate after installation.
- C. Above Grade – Defined as the area above finished grade for a building exterior and above top surface of any slabs (or other concrete work) on grade for a building interior. Above-grade raceways to comply with the following:
1. Install raceways concealed except at surface cabinets and for motor and equipment connection in electrical and mechanical rooms. Install a minimum of 6 inches from flues, steam pipes, or other heated lines. Provide flashing and counter-flashing for waterproofing of raceways, outlets, fittings, etc., which penetrate the roof. Route raceways parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Run embedded raceways in a direct line and, where possible, with long sweep bends and offsets. Provide sleeves in forms for new concrete walls, floor slabs and partitions for passage of raceways. Waterproof sleeved raceways where required.
 2. Provide raceway expansion joints for exposed and concealed raceways with necessary bonding conductor at building expansion joints and between buildings or structures and where required to compensate for raceway or building thermal expansion and contraction.
 3. Provide one empty 3/4 inch raceway for each three spare unused poles or spaces of each flush-mounted panelboard. Terminate empty 3/4 inch conduit in a junction box, which after completion, is accessible to facilitate future branch circuit extension.
 4. Provide raceway installation (with appropriate seal-offs, explosion-proof fittings, etc.) in special occupancy area, as required. Provide conduit seal-offs where portions of an interior raceway system pass through walls, ceiling or floors which separate adjacent rooms having substantially different maintained temperatures, as in refrigeration or cold storage rooms.
 5. Protect raceway in earth or fill with two coats of asphalt base paint. Touch up abrasions and wrench marks after conduit is in place.
 6. In lieu of above, protect raceways with a minimum of 20 mil tape approved for the purpose and overlapped a minimum of 1/2 tape width.
 7. Provide drag wire in spare or empty raceways. Tag both ends of wire denoting opposite and termination location with black India ink on flameproof linen tag.
- D. Below Grade: Defined as the area below finished grade for a building exterior and below or within the bottom floor slab for a building interior. Below grade raceways to comply to the following:
1. Project below-grade raceways 2 inches minimum above floor or equipment foundation. Install exterior underground conduits 24 inches minimum below finished grade. Do not penetrate waterproof membranes unless proper seal is provided.

- E. No raceway may be installed in a concrete slab except with the permission of the Structural Engineer and with the written consent of the Owner. Conduits embedded in structural concrete slabs shall have the following minimum thickness and shall conform to the following:

Raceway Sizes	Minimum Thickness of Concrete Slab
3/4"	4 - 1/2"
1"	5"

1. Unless specifically approved in writing, raceways 1-1/4 inch size and larger shall not be installed in structural concrete slabs.
 2. In no case will installation of raceways be permitted to interfere with the proper placement of principal reinforcement.
 3. Raceways in structural slabs shall be placed between the upper and the lower layers of reinforcing steel. This will require careful bending of conduits.
 4. Raceways embedded in concrete slabs shall be spaced not less than 8 inches on centers and as widely spaced as possible where they converge at panels or junction boxes.
 5. Raceways running parallel to slab supports, such as beams, columns and structural walls, shall be installed not less than 12 inches from such supporting elements.
 6. To prevent displacement during concrete pour of lift slab, saddle supports for conduit, outlet boxes, junction boxes, inserts, etc., shall be secured with suitable adhesives.
- F. Rigid non-metallic conduit installations shall conform to the following:
1. All joints are to be made by the solvent cementing method using the material recommended by the raceway manufacturer. Fittings, cement and conduit shall be supplied by the same manufacturer.
 2. Raceway cutoffs shall be square and made by handsaw or other approved means which does not deform the conduit. Raceway shall be reamed prior to solvent cementing to couplings, adapters, or fittings.
 3. Electrical devices which are served by PVC raceways to be grounded by means of ground wire pulled in the raceway.
 4. Male box adapters shall be used for all box or raceway fittings to terminate plastic raceways.
 5. Where separable terminations are required, they shall be made using PVC threaded adapters with locknuts or bushings. If such terminations must be watertight, "O" rings shall be installed.
 6. Bends shall be made by methods that do not deform or damage the conduit. The radii of field bends shall not be less than those established by the NEC.
 7. Raceway expansion fittings shall be provided in accordance with NEC. The position of the expansion fitting shall be adjusted proportional to the temperature at installation.
 8. Raceway supports shall be installed in such a manner to allow the PVC conduit to slide through the supports as the temperature changes.
 9. Elbows must be galvanized rigid steel.
 10. Rigid non-metallic conduit is not permitted to be installed within the building.
- G. Raceways in hung ceilings shall be run on and secured to slab or primary structural members of ceiling, not to lathing channels or T-bars or other elements which are the direct supports of the ceiling panels. Secure conduit firmly to steel by clips and fittings designed for that purpose. Install as high as possible, but not less than, 1-0" above hung ceilings.
- H. Exposed raceways shall be run parallel or at right angles with building lines. Secure raceway clamps or supports to masonry materials by toggle bolts, expansion bolts, or steel inserts. Install raceway on steel construction with approved clamps which do not depend on friction or set-screw pressure alone.

- I. Clear raceway of all obstructions and dirt prior to pulling in wires or cables. This shall be done with ball mandrel (diameter approximately 85% of conduit inside diameter) followed by close fitting wire brush and wad of felt or similar material. This assembly may be pulled in together with, but ahead of the cable being installed. All empty raceways shall be similarly cleaned. Clear any raceway which rejects ball mandrel.
- J. Support less than 2 inch trade size, vertically run, raceways at intervals no greater than eight feet. Support such raceways, 2 inch trade size or larger, at intervals no greater than 10 feet.
- K. Support less than 1 inch trade size horizontally run, raceways at intervals not greater than 7 feet. Support such raceways, 1 inch trade size or larger, at intervals no greater than 10 feet.

3.03 WIREWAY AND AUXILIARY GUTTER

- A. Wireways installed in hung ceilings shall be placed such that the cover will hinge upward from the side.
- B. A 12 inch clear work space shall be provided from wireway cover when it is in the open position.

3.04 OUTLET, JUNCTION, AND PULLBOXES

- A. Provide outlet, junction, and pullboxes as indicated on the Drawings and as required for the complete installation of the various electrical systems, and to facilitate proper pulling of wires and cables. J-boxes and pullboxes shall be sized per NEC minimum.
- B. The exact location of outlets and equipment is governed by structural conditions and obstructions or other equipment items. When necessary, relocate outlets so that when fixtures or equipment are installed, they will be symmetrically located according to the room layout and will not interfere with other work or equipment. Verify final location of outlets, panels equipment, etc., with Architect.
- C. Back-to-back outlets in the same wall or "thru-wall" type boxes are not permitted. Provide 12 inch (minimum) spacing for outlets shown on opposite sides of a common wall to minimize sound transmission.

3.05 FLOOR BOXES

- A. Reference shall be made to other sections of this specification for floor boxes.

END OF SECTION

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Condition and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Identification for electrical raceways
 - 2. Identification of power and control cables
 - 3. Identification for branch circuit and feeder conductors
 - 4. Underground-line warning tape
 - 5. Warning labels and signs per N.E.C.
 - 6. Instruction signs
 - 7. Identification labels for distribution equipment, junction boxes, cabinets and miscellaneous equipment.

1.03 SUBMITTALS

- A. Product Data: Furnish type of material to be supplied for each electrical identification product indicated.

1.04 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
 - 1. Comply with ANSI A13.1
 - 2. Comply with NFPA 70
 - 3. Comply with 29 CFR 1910.144 and 29 CFR 1910.145
 - 4. Comply with ANSI Z535.4 for safety signs and labels

1.05 COORDINATION

- A. Coordinate identification names, abbreviations, colors and features with requirements in the Contract Documents, shop drawings, manufacturer's wiring diagrams and operation and manual and with those required by codes and standards.

PART 2 - PRODUCTS**2.01 POWER RACEWAY AND METAL CLAD CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Raceway Colors for Circuits at 600 V or Less
 - 1. Black letters on an orange field.
 - 2. Fire Alarm Circuits: Red letters on natural field.
 - 3. Legend: Indicate voltage and system or service type.
- C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.02 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.03 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, Bright-Colored, Continuous-Printed, Polyethylene Tape
 - 1. Not less than 6 inches wide by 4 mils thick.
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend shall indicate type of underground line.

2.04 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

2.05 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
 - 1. Engraved legend with black letters on white face.
 - 2. Punched or drilled for mechanical fasteners.
 - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.06 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION**3.01 INSTALLATION**

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 90A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands.
 - 1. Fire Alarm System: Red
 - 2. Fire-Suppression Supervisory and Control System: Red and Yellow
 - 3. Combined Fire Alarm and Security System: Red and Blue
 - 4. Security System: Blue and Yellow
 - 5. Mechanical and Electrical Supervisory System: Green and Blue
 - 6. Telecommunication System: Green and Yellow
 - 7. Control Wiring: Green and Red

- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

3.02 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power
 - 2. Power
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - a. Colors for 208/120-V Circuits
 - 1) Phase A: Black
 - 2) Phase B: Red
 - 3) Phase C: Blue
 - 4) Neutral: White
 - 5) Ground: Green
 - b. Colors for 480/277-V Circuits
 - 1) Phase A: Brown
 - 2) Phase B: Orange
 - 3) Phase C: Yellow
 - 4) Neutral: White
 - 5) Ground: Green
 - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- C. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

- F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install marking tape at flush-mounted panelboards and similar equipment in finished spaces.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide five lines of text.
 - 1) First Line: 1/2-inch letters on the first line stating equipment name.
 - 2) Second Line (if applicable): 3/8-inch letters stating the existing equipment name in parentheses ().
 - 3) Third Line: 3/8-inch letters stating voltage/phase.
 - 4) Fourth Line: 3/8-inch letters stating the breaker number, panel name and room number/name (Owner's room number) from which the equipment is fed.
 - 5) Fifth Line: 3/8-inch letters stating function and/or equipment which it controls.
 - 2. Equipment to be Labeled
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Switchboards.
 - d. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - e. Substations.
 - f. Emergency system boxes and enclosures.
 - g. Enclosed switches.
 - h. Enclosed circuit breakers.
 - i. Enclosed controllers.
 - j. Contactors.
 - k. Remote-controlled switches, dimmer modules, and control devices.
 - l. Battery-invert units.
 - m. Monitoring and control equipment.

END OF SECTION

SECTION 260924 - OCCUPANCY SENSOR**PART 1 - GENERAL****1.01 STIPULATIONS**

- A. The specifications sections "General Conditions", "Special Requirements" and "General Requirements" form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.02 SUMMARY

- A. The following specifications detail the minimum performance and related criteria for occupancy sensors proposed for this project. Any deviations from this specification must be documented in writing and submitted to the Architect prior to the issuance of any contracts and must also include all associated cost savings or additions, including but not limited to equipment, equipment installation, power wiring labor and materials, programming, documentation and project management.
- B. Section Includes
 - 1. Provide, install and test an occupancy sensor control system as specified herein for the areas indicated on the drawings and specifications.
- C. Related Sections
 - 1. Section 260533 - Raceways and Boxes for Electrical Systems
 - 2. Section 260519 - Low Voltage Electrical Power Conductors And Cables
 - 3. Section 265100 - Interior Lighting

1.03 REFERENCES

- A. Underwriters Laboratories Inc. (UL)
- B. National Electrical Code (NEC)
- C. Passive Infrared (PIR)
- D. Passive Infrared/Microphonic (PDT)

1.04 SYSTEM DESCRIPTION

- A. The Occupancy Sensor system shall sense the presence of human activity within the desired space and fully control the "On" / "Off" function of the loads automatically. Sensors shall turn "On" the load within 2 feet of entrance and shall not initiate "On" outside of entrance. Sensing technologies shall be completely passive in nature. The occupancy sensor system shall not emit or interfere with any electronic device, or human characteristic. Acceptable technologies are Passive Infrared (PIR), Microphonic, Ultrasonic, and/or Passive Dual Technology - PIR/Microphonic or PIR/Ultrasonic (PDT) as specified on the drawings or as required for the application. Time Delay settings shall be factory set at 10 minutes, and shall not be adjusted unless specifically instructed by Architect. This delay selection is based on lamp life vs. energy savings and sensor performance. Maximum adjustment shall be 20 minutes. Automatic adjustments to this delay period by the sensor shall not be permitted. Installer, in accordance with manufacturer's recommendation, shall determine final sensor location. All sensors shall have non-adjustable factory calibrated sensitivity for maximum performance. Time Delay and Photocell field adjustments shall be provided as needed. The installing contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.05 SUBMITTALS

- A. Shall include catalog cut sheets with performance specifications including historical testing data demonstrating complete compliance to all of the specifications herein.

1.06 APPROVALS

- A. Complete catalog data, specifications, and technical information on alternate equipment must be provided including all associated cost savings or additions, including but not limited to equipment, equipment installation, power wiring and materials, programming, documentation and project management.

1.07 QUALITY INSURANCE

- A. Manufacturer shall have a minimum of 10 years continuous experience in the manufacturing of occupancy sensors.
- B. All devices shall be UL Listed under Energy Management Equipment, or Industrial Control Equipment.
- C. In high humidity or cold environments, the sensors must be conformably coated and rated for condensing humidity and -40 degree Fahrenheit operation.

1.08 PROJECT/SITE CONDITIONS

- A. Wall Switch occupancy sensors shall operate in an ambient temperature range of 14°F to 85°F with a low temperature, PIR -40°F/PDT -4°F, and high humidity option available. Storage ambient temperature range of -14°F to 160°F.
- B. Low Voltage occupancy sensors shall operate in an ambient temperature range of 14°F to 160°F with a low temperature, PIR -40°F/PDT -4°F, and high humidity option available. Storage ambient temperature range of -14°F to 160°F.
- C. Low Voltage wide view occupancy sensors shall operate in an ambient temperature range of -14°F to 85°F with a low temperature, PIR -40°F/PDT -4°F, and high humidity option available. Storage ambient temperature range of -14°F to 160°F.

1.09 WARRANTY

- A. The manufacturer shall provide a full five-year limited warranty on all equipment supplied. The warranty shall cover 100% of the parts and manufacturers labor costs required over the first five-years, which are directly attributable to the manufacturer. Warranty coverage shall begin on the date of final acceptance.

PART 2 - PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS**

- A. Provide occupancy sensors by the following manufacturers or approved equal:
 - 1. Sensor Switch, Inc.
 - 2. Watt Stopper
 - 3. Leviton
 - 4. Hubbell Building Automation
- B. The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any submittals made are for products/systems that meet or exceed the specifications included herein.
- C. All occupancy sensors and associated accessories shall have the same manufacturer.
- D. Occupancy sensors shall coordinate with and have the ability to communicate with the room dimming systems, as required.

2.02 WALL SWITCH SENSORS - SMALL AREAS

- A. Sensor shall recess into single gang switch box and fit a standard decorator opening.
- B. Sensor must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
- C. Sensor shall use PIR sensing incorporating a nominal one half inch focal length lens viewing 9 inches above and below horizontal view pattern measured at 10 feet.

- D. Sensor shall have optional features for photocell/daylight override or vandal resistant lens as specified.
- E. In areas with inboard/outboard switching or two circuits, sensor shall provide two dedicated relays and override switches. Each relay shall have independent programmable time delays.
- F. In areas with obstructions to the occupant's workspace, sensor shall utilize dual technology sensing (PDT).
- G. All models shall have "Reduced Turn On". This is a field programmable function for problematic areas with unforeseen reflective surfaces. False turn on shall be eliminated with this feature.
- H. Sensor shall be the following Sensor Switch model numbers or equal. Device color and optional features as specified.
 - 1. WSD (Passive Infrared)
 - 2. WSD-2P (Passive Infrared inboard/outboard or two circuits)
 - 3. WSD-PDT (Passive Dual Technology)
 - 4. WSD-PDT-2P (Passive Dual Technology inboard/outboard or two circuits)
 - 5. WSD-SA (Passive Infrared Semi-Automatic)
 - 6. WSD-PDT-SA (Passive Dual Technology Semi-Automatic)

2.03 LOW VOLTAGE SENSORS

- A. Sensors shall operate on a class 2, three-conductor system. Sensors shall operate on 12 to 24 VAC or VDC and consume no more than 5 milliamps so that up to 14 sensors may be connected to a single power pack.
- B. Upon initial power up, sensors must immediately turn on. Power packs may be wired on the line or load side of local switching and must not exhibit any delays when switch is energized.
- C. In areas with clear line of site view of the workspace, sensors shall use PIR detection. In areas with obstructions, sensors shall use dual technology detection (PDT).
- D. Sensors shall be the following Sensor Switch model numbers or equal with device features as specified.
 - 1. WSD-LV (Passive Infrared wall)
 - 2. WSD-LV-PDT (Passive Dual Technology wall)
 - 3. CM-9 (Passive Infrared ceiling)
 - 4. CM-PDT (Passive Dual Technology ceiling)
 - 5. CM-10 (Passive Infrared ceiling - Extended Range)
 - 6. CM-PDT-10 (Passive Dual Technology ceiling - Extended Range)
 - 7. WV-16 (Passive Infrared wall mount)
 - 8. WV-PDT (Passive Dual Technology wall mount)
 - 9. CM-6 (Passive Infrared high bay)

2.04 POWER PACKS

- A. Power Packs shall accept 120 or 277 VAC, be plenum rated, and provide class 2 power for up to 14 remote sensors.
- B. Power Pack shall securely mount to junction location through a threaded ½ inch chase nipple. Plastic clips into junction box shall not be accepted. All class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads.
 - 1. UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
- C. When required by local code, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
- D. Power Pack shall incorporate a class 1 relay and an A/C electronic switching device. The A/C electronic switching device shall make and break the load, while the relay shall carry the current in the On condition. This system shall provide full 20 amp switching of all load types.

- E. Power packs shall be single circuit or two circuits. Slave packs may be used to control additional circuits. When two circuit power packs, or slave packs are used, the power packs must be wired directly to circuit breaker. Otherwise, power packs may be wired on the line or load side of the local switch.
- F. Power packs shall be the following Sensor Switch model numbers.
 - 1. PP20 (Single Pole)
 - 2. PP20 2P (Two Pole)
 - 3. SP20 (Slave Pack)

2.05 LINE VOLTAGE OCCUPANCY SENSORS

- A. Sensors shall be self-contained and accept Class 1 wiring directly without the use of a power pack.
- B. The installing contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's recommendations.
- C. In areas with periodic or permanent obstruction to a sensor's field of view, sensors that utilize dual technology (PIR/Microphonics) detection shall be used.
- D. Sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.
- E. Line and load wire connections shall be interchangeable, such that installer cannot make an improper connection to a line/load in a manner that will cause malfunction or damage to the sensor.
- F. Multiple sensors controlling the same load shall be wired in parallel.
- G. For applications requiring independent control of two loads, a sensor with two dual relays shall be required. Each relay shall have independent programmable occupancy time delays.
- H. Dual relay sensors shall have an optional operational mode called "Alternating On" where when during unoccupied periods, one relay is always left closed (thus one load is always on). The particular relay that is left closed alternates each cycle so that the aging of the connected lamps is even.
- I. Sensors shall be capable of switching both 120 VAC and 277 VAC and run off of 50/60 Hz power. A version capable of switching 347 VAC shall also be available. Load ratings shall be 800 W @ 120 VAC, 1200 W @ 277 VAC, 1500 W @ 347 VAC, and ¼ HP motor load.
- J. Specific sensors capable of switching 5 Amps of two phase power (208/240 or 480 VAC) shall be available. These sensors shall always simultaneously switch both phases as per NEC guidelines.
- K. Wall mounted sensors must be installed at 7 to 8 feet above the floor. Single and two circuit units shall be available.
- L. Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.
- M. Sensors shall have additional features for on/off photocell control, automatic dimming control photocell, high/low occupancy based dimming, and usage in low temperature/high humidity environments where required.
- N. Sensors shall be the following Sensor Switch model numbers.
 - 1. CMR 9/CMR 9 2P (Standard Range 360°, PIR, Ceiling Mount – Single/Two Pole)
 - 2. CMR PDT 9/CMR PDT 2P (Standard Range 360°, PIR/Microphonics Dual Technology, Ceiling Mount – Single/Two Pole)
 - 3. CMR 10/CMR 10 2P (Extended Range 360°, PIR, Ceiling Mount – Single/Two Pole)
 - 4. CMR PDT 10/CMR PDT 10 2P (Extended Range 360°, PIR/Microphonics Dual Technology, Ceiling Mount – Single/Two Pole)
 - 5. CMRB 10/CMRB 10 2P (Extended Range 360°, PIR, Fixture Mount Box – Single/Two Pole)
 - 6. CMRB PDT 10/CMRB PDT 10 2P (Extended Range 360°, PIR/Microphonics Dual Technology, Fixture Mount Box – Single/Two Pole)

7. WVR 16/WVR 16 2P (Wide View, PIR, Wall Mount – Single / Two Pole)
 8. WVR PDT 16/WVR PDT 2P (Wide View, PIR/Microphonics Dual Technology, Wall Mount – Single/Two Pole)
- O. Sensors with a recessed profile are acceptable substitutes for above ceiling mount or fixture mount sensors (e.g. CMR 9 => RMR 9)

2.06 TIMER SWITCHES

- A. Unit shall be white with clear protective lens over the pushbuttons and recess into single gang switch box and fit a standard decorator opening.
- B. Unit shall be capable of six different on and off set points per day with varied schedules for each day of the week with settings in minimum 1-minute increments. All settings shall be made using 6 pushbuttons on the face of the unit. A manual override must be available using 1 of the pushbuttons.
- C. When unit is in run mode, a liquid crystal display shall continuously show time of day, day of week, timer mode, and load status.
- D. In case of power failure, memory must be maintained by means of a AA alkaline battery which is supplied with the unit. A low battery indicator shall appear in the display when battery needs replacement.
- E. Unit shall be constructed with 3 wires and capable of use as a stand-alone time switch or in conjunction with multiple standard switches in 3-way or 4-way applications, or with any standard dimmer switch for 2 or more switch control points with 1 dimming control point.
- F. Unit shall have an isolated single pole single throw switch which allows it to switch any load type including PAR lamps and motor loads from 120 to 277 volts AC or 12 to 28 volts DC within the specified ratings.
- G. Unit shall be capable of operating in ambient temperatures ranging from 32°F to 104°F.
- H. Timer Switches shall be the following Sensor Switch model number or equal.
 1. SSA-200

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install equipment level and plumb and according to manufacturer's written instructions.
- B. Mount lighting control devices according to manufacturer's written instructions and requirements.
- C. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounted devices.
- D. Wall sensor/switches shall be mounted at standard wall switch mounting height, unless otherwise noted.

3.02 CONTROL WIRING INSTALLATION

- A. Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Section 260519 "Low Voltage Electrical Power Conductors and Cables" for low-voltage connections.
- B. Wiring Method: Install all wiring in raceway as specified in Section 260533 "Raceways and Boxes for Electrical Systems".
- C. Bundle, train, and support wiring in enclosures.
- D. Ground equipment.
- E. Connections: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.03 IDENTIFICATION

- A. Identify components and power and control wiring.

3.04 FIELD QUALITY CONTROL

- A. Schedule visual and mechanical inspections and electrical tests with at least seven day's advance notice.
- B. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.
- C. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturer's recommended torque values.
- D. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
 - 1. Continuity tests of circuits.
 - 2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - a. Include testing of devices under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
- E. Correct deficiencies, make necessary adjustment, and retest. Verify that specified requirements are met.
- F. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- G. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.05 CLEANING

- A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
 - 1. Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of two hour's training.
 - 2. Training Aid: Use the approved final version of maintenance manuals as a training aid.
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

3.07 ON-SITE ASSISTANCE

- A. Occupancy Adjustments at no additional cost within one year of date of Substantial Completion. Provide up to two Project site visits, when requested, to make program changes, and adjust controls to suit actual conditions.

END OF SECTION

SECTION 260926 - LIGHTING CONTROL PANELBOARDS**PART 1 - GENERAL****1.01 STIPULATIONS**

- A. The specifications sections "General Conditions", "Special Requirements" and "General Requirements" form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 SYSTEM DESCRIPTION

- A. The panelboard lighting control system shall automatically control lighting and other loads within the facility.
- B. The system shall be used as a networked system for controlling loads via external low voltage inputs, and/or from its internal time-of-day clock.
- C. The system shall include branch circuit overcurrent protection and remote power switching, low voltage switch inputs, control logic functionality and shall all fit within a standard lighting panelboard enclosure.
- D. To assure seamless integration, all major system components shall have a common manufacturer.

1.04 REFERENCES

- A. Required UL Listings: UL 489 for Molded Case Circuit Breakers, UL 67 for Panelboards, UL 50 for Boxes and Enclosures, and UL 916 for Energy Management Equipment.
- B. NEMA Compliance: PB-1 for Panelboards
- C. NEC 110-10 Compliance.
- D. FCC Approval: All assemblies are to be in compliance with FCC Emissions Standards specified in Part 15 Subpart J for Class A applications.

1.05 SYSTEM START-UP AND TRAINING

- A. Start-Up: After the system has been installed, and the documentation delivered to the Owner, the contractor shall secure the services of a factory trained manufacturer's representative for one day to verify correct operation of all system components.
- B. Training: At system start-up, the contractor shall arrange for the factory representative to train the Owner's personnel.
- C. Factory Support: Factory fax/telephone support shall be available free of charge during normal business hours to answer programming and application questions during the warranty period.

1.06 WARRANTY

- A. Manufacturer shall warrant specified equipment to be free from defects in materials and workmanship for the lesser of one year from the date of installation or eighteen months from date of purchase.

1.07 RELATED DOCUMENTS

- A. All drawings including General Construction, Structural, Theatrical, Food Service, Mechanical, Electrical and Telecommunications, and General Conditions of the contract, including Supplemental Provisions and Division 1 Specifications Sections, apply to this section.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. The panelboard lighting control system shall be POW-R-COMMAND as manufactured by Eaton or approved equal by Square 'D', GE, or Siemens.

2.02 PANELBOARD LIGHTING CONTROL SYSTEM

- A. The lighting control system shall consist of a microprocessor-based control electronics with remote operated circuit breakers. The circuit breakers shall provide overcurrent protection meeting or exceeding the fault current of the system that the panelboard is being applied.
1. The lighting control system shall meet or exceed the following capabilities:
 - a. Individual remote control for 42 branch circuits.
 - b. Up to sixteen 2-wire maintained dry-contact inputs for connection to external low voltage (24 VDC or below) switch contacts for override capability.
 - c. Zone creation of multiple branch circuits and control of individual branch circuits or zones.
 - d. Individual branch circuit and zone override.
 - e. True closed loop control by monitoring branch circuit breaker status based on actual system voltage at load side terminal.
 - f. Downloadable firmware that will permit field installation of newest features in existing systems.
 - g. The capability to remotely control slave panelboards.
- B. All lighting control components shall be installed in a conventional panelboard enclosure. Suitable barriers between Class 1 and Class 2 wiring shall be provided.

2.03 HARDWARE

- A. To minimize installation labor and space requirements, the remote operated circuit breakers, power interface module and control module shall be integral to the lighting panelboard.
- B. Remote Operated Circuit Breakers
1. All remote operated branch circuit breakers shall provide overload and short circuit protection suitable for that location in the electrical system, as defined in the panelboard schedules. Remote operated power switching devices shall provide the following:
 - a. Load switching endurance rating of 200,000 open/close operations at full load and 0.8 lagging power factor. Switching devices with lower endurance ratings may be judged to be acceptable, but must be provided with 100% spare switching devices for each circuit to ensure an equivalent total number of operations.
 - b. 20A, and 30A current ratings shall be available for remote operated power switching devices. Power switching devices shall provide integral branch circuit overcurrent protection as required by the National Electrical Code (NEC), and shall be either fully rated or shall have published series connected ratings for providing adequate protection at that point in the system.
 - c. Power switching devices shall be available in single-, two-, and three-pole configurations.
 - d. UL Listing SWD rating on 20A 1-, 2- and 3-pole branches, UL Listed HACR rating and UL Listed HID rating on all remotely operated power switching devices.
 - e. Handle that mechanically opens power switching device contacts when moved to the OFF position and disables remote control capabilities of the device.
 - f. Operating mode selector button on each power switching device shall be provided to enable or disable remote operated function of the device independent of the handle.

- g. Visible flag to clearly indicate the status of the circuit breaker contacts. Status condition shall include: ON, OFF, TRIPPED. The visible flag shall be mechanical in nature, directly tied to the breaker mechanism, and shall be provided in addition to any status indicator supplied by the system electronics. Switching devices not equipped with such an indicator shall be equipped with an alarm and auxiliary contacts wired to LED or neon pilot lights suitable for wiring to external pilot devices.
 - h. All individual power switching devices rated for 277 or 480Y/277 VAC shall have a short circuit interrupting rating of 14,000 rms symmetrical amperes.
 - i. Power switching devices shall meet all NEC requirements for circuit breakers; shall be UL Listed as circuit breakers.
 - j. All electronic modules and circuit breakers in the panelboard shall be mounted in the positions and control the loads as indicated on the panelboard drawings.
 - k. Panelboards shall accept standard circuit breakers for loads not controlled by the system.
- C. Interconnections
- 1. All interconnections between circuit breakers, control buses and power interface modules shall meet NEC and UL requirements for Class 1 control circuits.
 - 2. Modular control buses shall be used to provide control power and communications to the remote operated branch breakers.
- D. Power Interface Module
- 1. Power interface module shall be provided to supply control power for the operation of the remotely operated circuit breakers, power for low voltage inputs, and power for the electronics and communications.
 - 2. The module shall provide screw type terminals for up to sixteen 2-wire maintained or 2-wire momentary inputs, or eight 3-wire momentary inputs for connection to external low voltage (24 VDC or below) switch contacts.
- E. Control Module
- 1. A 2000 level system control module shall be provided where indicated. The control module shall provide time clock, communications, and programming functionality.
 - a. Display control module shall have high-resolution graphics LCD display and keypad that will permit programming of the system, control override of the breaker status, give electronic indication of the breaker status and display diagnostic information at the front panel.
 - 1) Provide one (1) display control module in each POW-R-COMMAND (or approved equal) panel. Refer to panel schedules for type of panel.
 - b. The control module with time-of-day control shall meet or exceed the following capabilities:
 - 1) Ability to execute up to 4 daily schedules.
 - 2) 365-day calendar with automatic leap year correction, and daylight savings time adjustment
 - 3) Astronomical clock with sunrise/sunset
 - 4) 7-day repeating scheduler
 - 5) 12-hour AM/PM or 24-hour military time format
 - 6) 32 special holiday/event periods
 - 7) Programmable sequence delay of circuit breakers
 - 8) Local display of day/date/time (with available LCD display)
 - 9) Adjustable timer for inputs (time overrides)
 - 10) Priority maintained inputs
 - 11) Adjustable flash notice assignable to time-of-day or timed inputs commands.
 - 12) Capacitor back-up power for time clock back up for 30 days.
 - 13) RS-485 and RS-232 Communications ports.
 - 2. The control module shall have downloadable firmware so that the latest production features may be added in the future without replacing the module.

PART 3 - EXECUTION

3.01 EQUIPMENT INSTALLATION AND DOCUMENTATION

- A. Installation
 - 1. The panelboard lighting control system with remotely operated circuit breakers shall be installed and wired completely as shown on the plans by the contractor.
 - 2. All remote control wiring shall be installed in accordance with Article 725, Class 2 of the National Electrical Code and local codes.
 - 3. Wire size shall be as recommended by manufacturer, but shall not be smaller than #24 AWG.
 - 4. Install system in accordance with manufacturer's written instructions and the NEC.
 - 5. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.

END OF SECTION

SECTION 262416 – PANELBOARDS**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. General: Provide panelboards in accordance with the Contract Documents.

1.02 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
1. Panelboards
 - a. UL Standards #67.
 - b. UL Standard 50 Cabinet and Boxes
 - c. Federal Standard W-P-115.
 - d. NEMA Standard PB-1
 - e. Circuit Breakers – Type 1, Class 1.

1.03 SUBMITTALS

- A. Submittals will be furnished. Submittals failing to meet the following criteria will be returned without a review or acceptance.
- B. With each panelboard drawing the following is required:
1. Show main devices and lug sizes; branch circuit device sizes and arrangement; bus ampacities; withstandability and short circuit rating; dimensions and construction; gutter and backbox dimensions; nameplate and legend; protective coating; and all pertinent details of panel, enclosure, cover, and method of securing cover and lock.

1.04 QUALITY ASSURANCE

- A. Each panelboard as a complete and finished product shall receive a single integrated equipment rating by the manufacturer. The integrated equipment short circuit rating shall certify that all equipment is capable of withstanding the thermal and magnetic stress of a fault equal to the value specified on the Drawings. Such rating shall be established by actual tests by the manufacturer on similar equipment. This certification shall be permanently affixed to each panelboard. Test data shall be submitted to the Engineer at time of submission of Acceptance Drawings.

PART 2 - PRODUCTS**2.01 APPROVED MANUFACTURERS**

- A. Manufacturers
1. Eaton
 2. Square D
 3. General Electric
 4. Siemens
- B. 277/480 volts circuit breaker type panelboards are to be equal to Eaton Pow-R – Line 2.
- C. 120/240 volts circuit breaker type panelboards are to be equal to Eaton Pow-R Line 1.
- D. Breaker distribution panelboards are to be equal to Eaton Pow-R-Line-4B.

2.02 PANELBOARDS IN GENERAL

- A. Provide panelboards consisting of an assembly of branch circuit switching and protective devices (circuit breakers, switch and fuse units, or combination thereof) mounted inside a dead front enclosure. Provide the number and size of these branch circuit devices as indicated by the circuiting, on the drawings, and in the schedules.

- B. Provide the following modifications and additional equipment as shown on the Drawings:
 - 1. Main circuit breakers.
 - 2. Sub-feed switches.
 - 3. Panelboard integral mounted relays and contactors.
- C. Interiors
 - 1. Rigid removable assembly of copper bus bars and interchangeable bolted branch circuit devices.
 - 2. Bus bars drilled to permit branch circuit devices of all sizes and number of poles to be interchangeable and installed in any spare space of sufficient size, without disturbing adjacent units; without removing main bus or branch circuit connectors and without machining, drilling, or tapping in the field.
 - 3. Arrange bus in sequence or distributed phasing so that multipole circuit breaker can replace any group of single circuit breakers of the same size.
 - 4. Provide copper neutral bus in each panelboard.
 - 5. Provide copper ground bus in each panelboard.
- D. Enclosure
 - 1. Code gauge steel box galvanized.
 - 2. Provide a bolt-on ground connector to inside of enclosure.
 - 3. Flush mounted in finished areas and where indicated. Surface mount elsewhere.
- E. Front
 - 1. Doors must be provided on all lighting and power distribution panels. On switch and fuse panelboards, doors for overcurrent devices are not to be provided.
 - 2. Heavy code gauge steel as required to maintain panel face flat.
 - 3. Hold front closed with trim clamps.
 - 4. Factory finished in medium gray enamel or two coats of air-drying lacquer over a rust inhibitor.
 - 5. Provide directory for total number of poles.
 - 6. Provide approved lock. All panels keyed alike. Furnish 4 sets of matching keys to the Owner.
 - 7. Welded angle rest at the bottom of the door to facilitate cover installation.
 - 8. Doors over 48" in height shall have auxiliary fasteners at top and bottom of door in addition to lock and catch.
 - 9. Door-in-door construction.
- F. Terminal lugs
 - 1. Bolted type, labeled for either copper or aluminum conductors.
 - 2. Locate main lugs properly at top or bottom, depending where main feeder enters.
- G. Electrical Ratings
 - 1. Panelboards are to be rated 120/208 or 277/480 volts 3 phase, 4 wire, full neutral with ampacities as indicated on the Drawings (unless otherwise noted).
 - 2. Short circuit withstand ratings shall be as indicated on the Drawings. Panelboards shall be fully rated. Series rated not acceptable.
 - 3. Where indicated, provide panelboards having a "service entrance" Type UL label with neutrals factory bonded to frame or enclosure.
- H. Circuit Breaker Devices
 - 1. Plastic molded case. Completely sealed enclosure. Toggle type operating handle. Trip ampere rating and ON/OFF indication clearly visible.
 - 2. Thermal-magnetic trip-free, trip-indicating, quick-make, quick-break, with inverse time delay characteristics. Single-handle and common tripping multipole breakers.
 - 3. Silver alloy contacts with auxiliary arc-quenching devices.
 - 4. Panelboard must be of the type which will accept the field installation of shunt trip devices of 60 amperes or less on the branch devices.
 - 5. Interrupting capacities shall be as indicated on the Drawings. In general, 120/208 volt devices shall be not less than (10,000 AIC). And 277/480 not less than (14,000 AIC).

6. Arc Fault Circuit Breaker Devices shall be equipped with 5mA ground fault protection integrated design capability. Provide arc fault breakers (AFCI) for all bedroom lighting and power 15-ampere and 20-ampere single pole 120Volt circuits indicated on the plans.
7. For lighting circuits that are controlled at panel, provide devices labeled "SWD" for switching purposes.
8. Bolted type terminals UL listed for either aluminum or copper 75 degrees C cables.
9. Provide main breakers in panels served from transformers.
10. Locate next to each breaker or space unit an individual number.
11. Circuit breakers serving kitchen equipment beneath cooking hoods shall include a shunt trip coil.
12. Panelboard shall accept circuit breakers from 15 ampere to 100 ampere.
- I. Life Safety Circuit Breakers
 1. For all main and sub-feed circuit breakers for the life safety distribution system, the circuit breakers shall be provided with electronic trip unit with LSI settings. This is required for selective coordination. Branch circuit breakers in panelboards may be thermal magnetic trip.
- J. Ground Fault Interrupters
 1. Ground fault interrupter branch circuit breakers shall be as indicated in panel schedules. Circuit breakers shall be circuit interrupting which will operate manually for normal switching functions and automatically under overload, short circuit, and 0.005 amp line-to-ground fault conditions. The operation mechanism shall be entirely trip-free so that contact cannot be held closed against an abnormal overcurrent, short circuit, or ground fault condition. The device shall be bolt-on type with insulated case construction and shall be interchangeable with standard 1 P breakers utilized in the panelboard.
- K. Switch and Fuse Devices
 1. Quick-make, quick-break, dead-front type. Each switch a self-contained unit, externally operable from the front.
 2. Fuse and switch compartment interlocked to prevent access to the fuse compartment until switch is thrown to "OFF" position. Interlock intentionally releasable by externally applied tool to permit checking switch and fuses under load.
 3. Switch units interchangeable for replacement, without disturbing balance of distribution panelboard's operation.
 4. Switches are to reject fuses other than those specified.
 5. Provide Class R rejection type fuses as specified elsewhere.
 6. Provide spare fuses as specified elsewhere.

2.03 DISTRIBUTION PANELBOARDS

- A. Distribution panelboards with bolt-on devices shall have interrupting ratings as specified herein or indicated on the drawings. Panelboards shall be fully rated. Panelboards shall be Eaton type Pow-R-Line 4B.
- B. Where indicated, provide circuit breakers UL listed for application at 80% of their continuous ampere rating in their intended enclosure.
- C. Distribution Panelboards – Fusible Switch Type
 1. Distribution panelboards shall have fusible switches as specified and include fuses with ratings indicated on the drawings. Panelboards shall be Eaton type Pow-R-Line 4F.
- D. Trip Units for Molded Case Circuit Breakers – 1200 A and Below
 1. Protective devices shall be molded case circuit breakers with inverse time and instantaneous tripping characteristics and shall be Eaton or approved equal.
 2. Circuit breakers shall be operated by a toggle-type handle and shall have a quick-make, quick-break over-center switching mechanism that is mechanically trip-free. Automatic tripping of the breaker shall be clearly indicated by the handle position. Contacts shall be nonwelding silver alloy and arc extinction shall be accomplished by means of DE-ION arc chutes. A push-to-trip button on the front of the circuit breaker shall provide a local manual means to exercise the trip mechanism.

3. Circuit breakers shall have a minimum symmetrical interrupting capacity as indicated on the drawings.
 4. Circuit breakers 225-ampere frame and below shall have thermal-magnetic trip units and inverse time-current characteristics.
 5. Circuit breakers 250-ampere through 1200-ampere frame shall have microprocessor-based rms sensing trip units.
 6. Ground fault protection shall be provided where indicated.
- E. Enclosure
1. Enclosures shall be at least 20 inches wide made from galvanized steel. Provide minimum gutter space in accordance with the National Electrical Code. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be sized to include the additional required wiring space. At least four interior mounting studs with adjustable nuts shall be provided.
 2. Enclosures shall be provided with blank ends.
- F. Nameplates
1. Provide an engraved nameplate for each panel section.

2.04 SURGE PROTECTIVE DEVICES

- A. Provide surge protective devices as specified in Section 264313.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Mount panel 4 feet to panel center but with maximum height of 6 feet 6 inches to handle of topmost switching device.
- B. Mount surface type panels a minimum of 1 inch off wall on channels.
- C. Connect feed-through panels to main feeder by insulated parallel gutter taps. Full-size tap for two panels on a common feeder. Increase cabinet width to accommodate gutter tap.
- D. Where flush mounted, the fire integrity of the wall in which it is installed must be maintained.
- E. Neatly arrange branch circuit wires and tie together in each gutter with Thomas & Betts nylon "Ty-Raps", or approved equal at minimum 4 inch intervals.
- F. Plug all knockouts removed and not utilized.

3.02 TOUCH UP AND CLEANING

- A. Vacuum all backboxes clean of debris after installation and prior to final payment.
- B. Touch up scratch marks, etc. with matching paint.

END OF SECTION

SECTION 262726 - WIRING DEVICES**PART 1 - GENERAL****1.01 DESCRIPTIONS**

- A. General: Provide wiring devices in accordance with the Contract Documents.

1.02 QUALITY ASSURANCE

- A. Switches and receptacles shall be of the same manufacturer.
- B. Reference shall be made to the drawings for additional wiring devices not noted in this section of the specifications.
- C. Manufacturer shall have a minimum of ten (10) years experience in the manufacture of wiring devices similar to those specified on this project.
- D. Manufacturer shall have ISO-9002 certification.

1.03 STANDARDS

- A. Switches: Federal Specifications WS-896E, NEMA WD-1, and UL 20.
- B. Receptacles: Federal Specification W-C-596, NEMA WD-1, NEMA WD-6, and UL 498.
- C. Ground Fault Circuit Interrupter Receptacles: UL 943 Class A.
- D. USB Receptacles: UL 1310
- E. Wall Dimmers: ANSI C62.41, UL 20.

1.04 SUBMITTALS

- A. Product Data: For each type of products.
- B. Shop Drawings: List and description of materials and the method for receptacle identification.

1.05 COLORS

- A. Device and coverplate (thermostatic) colors connected to the normal power system shall be confirmed with Architect prior to release unless otherwise indicated on the architectural drawings:
- B. Switches and receptacles connected to the emergency power system shall be red.
- C. Isolated ground receptacles shall be orange as specified below with orange triangle on face.
- D. SPD type receptacles shall be blue.

PART 2 - PRODUCTS**2.01 ACCEPTABLE MANUFACTURERS**

- A. Catalog numbers shall not be used to determine colors of devices and coverplates. Catalog numbers are used to establish minimum acceptable standard.
- B. Switches and Receptacles: Hubbell or equal, by Cooper Wiring Devices, Leviton, and Pass & Seymour.
- C. Wall Dimmers: Lutron or equal.
- D. Floor Boxes and Fittings
 - 1. Poke through type: Hubbell or equal.
 - 2. Recessed flush floor box type: Hubbell or equal.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.
 - 3. Receive Owner approval.
- D. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.
- E. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer

2.03 SWITCHES

- A. General
 - 1. Switches shall be of the type indicated on the Drawings.
 - 2. Switches shall be commercial specification grade, quiet type, 20A, 120/277V, 1 HP rated at 120V, 2HP rated at 277V, back and side wired, silent handle operation.
 - 3. Switch with pilot light shall be specified for applications where the load to be controlled is not in sight. Pilot light shall be long life, LED type and shall be on when the load is off.
- B. Lighting Switches
 - 1. Toggle Handle Type
 - a. Single pole: Hubbell: HBL1221.
 - b. 3-way: Hubbell: HBL1223.
 - c. 4-way: Hubbell: HBL1224.
 - d. Double pole: Hubbell: HBL1222.

2.04 RECEPTACLES

- A. General
 - 1. Receptacles shall be of the type indicated on the Drawings.
 - 2. Receptacles shall be heavy duty 20A specification grade, 125V, grounding type, back and side wired.
- B. Receptacles
 - 1. Single, 20A: Hubbell: HBL5361 **[color]**.
 - 2. Duplex, 20A: Hubbell: HBL5362 **[color]**.
- C. Special purpose receptacles: Rating as indicated on the Drawings.
- D. Weatherproof Receptacles and Cover
 - 1. Exterior weatherproof outlet shall be Hubbell. While in use, cast aluminum, 1 gang vertical, GFCI receptacle Catalog #WP26M or approved equal.

2.05 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic**[0.05-inch-thick]**.
 - 3. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations".

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General
 - 1. The exact location of wiring devices shall be determined by location of equipment and as detailed on the Architectural Drawings. Prior to installation the Owner has the right to have the devices relocated 25'-0" at no cost.
 - 2. Devices mounted above counters shall be 2 inches above the top of the backsplash to the bottom of the coverplate.

- B. Switches
 - 1. Mount switches vertically with the ON position on top.
 - 2. Mount switches on the strike side of doors, unless otherwise detailed on the drawings.
- C. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- D. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtail existing conductors is permitted, provided the outlet box is large enough.
- E. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- F. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- G. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- H. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.02 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.03 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections:
 - 1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 - 2. Test Instruments: Use instruments that comply with UL 1436.
 - 3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- D. Tests for Convenience Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- E. Wiring device will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION

SECTION 262813 – FUSES**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. General: Provide fuses in accordance with the Contract Documents.

1.02 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
1. UL Standard #198

1.03 SUBMITTALS

- A. Provide a complete set of shop drawings to include let-thru curves for each type of fuse, a schedule of spare fuse cabinets with a listing of fuses provided within each spare fuse cabinet, and dimensioned drawings of each spare fuse cabinet by type and size.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Mains, Feeders and Branch Circuits
1. General
 - a. All fuses shall be labeled as UL Class L or UL Class R, current limiting and rated for up to 200,000 amperes. Time delay Class R fuses shall be so labeled.
 2. Main Service and all Feeder Circuits
 - a. Fuses over 600 amperes shall be UL Class L. Fuses up to 600 amperes shall be UL Class RK1. If fuses directly feed motors or transformers, they shall be UL RK1, labeled Time-delay.
 3. Branch Circuits
 - a. Feeding circuit breaker panels shall be UL Class RK1.
 - b. Feeding motor circuits shall be UL Class RK1 labeled as Time-delay.
 4. All fuses shall be so selected as to provide a selectivity coordinated system.
 5. All fuses shall be of the same manufacturer.
 6. All fuses to be of the Class R type.
- B. Spares: Upon completion of the building, the contractor shall provide the Owner with spare fuses as indicated below:
1. 10 percent (minimum of 3) of each type and rating of installed fuses shall be supplied as spares.
 2. Spare fuse cabinets shall be provided to store the above spares.
 3. Spare fuse cabinets shall be provided as a minimum in the following locations:
 - a. Each main switchgear room.
 - b. Each major mechanical equipment room.
- C. Manufacturers
1. Littelfuse, Bussmann, Gould-Shawmut.

PART 3 - EXECUTION**3.01 GENERAL**

- A. Fuses shall not be installed until equipment is ready to be energized.
- B. All fuses shall be provided by the Electrical Contractor.

END OF SECTION

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Provide enclosed fusible disconnect switches and circuit breakers in accordance with the Contract Documents.

1.02 STANDARDS

- A. Except as modified by governing codes and by the Contract Documents, comply with the latest applicable provisions and latest recommendations of the following:
 - 1. UL Standards #98
 - 2. NEMA KS-1

1.03 SUBMITTALS

- A. Submit manufacturers' data for all disconnect switches and circuit breakers.

PART 2 - PRODUCTS**2.01 ENCLOSED SWITCHES**

- A. Enclosed switches shall be fused heavy-duty, single-throw knife switch with quick-make, quick-break mechanism, capable of full load operations. Meet NEMA and U.S. Government specifications for Class A switches. Install fused switches unless otherwise noted.
- B. Provide with contact arc-quenching devices, such as magnetic blowouts or snuffing plates. Provide self-aligning switchblades with silver alloy contact areas and designed so that arcing upon making and breaking does not occur on the final contact surfaces. Provide with high-pressure, spring-loaded contact. Mount switch parts on high-grade insulating base. All safety switches shall be fused unless otherwise noted.
- C. Enclosure: NEMA 1 with hinged door, and defeatable interlock when switch is in "On" position and can be positively padlocked in "on" and "off" positions. Utilize NEMA 3R (rain-tight) enclosure for exterior installations. NEMA 3R enclosures must be galvanized.
- D. Size fusing and number of poles as shown or as required. Where fused, the devices must be provided with UL listed rejection feature to reject all but Class R fuses. Provide horsepower rated switch to match motor load if no size is shown. Use 3 pole plus solid neutral switches on four wire circuits and 3 pole switches on all other circuits unless otherwise noted.
- E. Lugs must be UL listed for aluminum and/or copper conductors and be front removable.
- F. Manufacturer to be the same as that for transformers, switchgear, etc.
- G. Acceptable manufacturers: Square D, Cutler-Hammer, General Electric or Siemens.

2.02 TOGGLE TYPE MANUAL CONTROL SWITCHES

- A. Provide switches that operate at their full rating with fluorescent, tungsten, and resistance loads – and at 80% of their rated capacity with motor loads.
- B. Switches to be heavy duty and have:
 - 1. Arc-resisting bodies.
 - 2. Slow make-and-break mechanisms.
 - 3. Silver alloy contact buttons.
 - 4. Side or back wiring with up to No. 10 AWG solid conductors.
- C. Acceptable manufacturers: Square D Class 2510, 11, or 12; General Electric Type RB and Siemens Class MMS with enclosure.

2.03 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
 - 1. Cutler-Hammer
 - 2. General Electric Company
 - 3. Siemens
 - 4. Square 'D'
- B. General Requirements: Comply with UL489, NEMA AB1, and NEMA AB3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers for circuit breakers 100 amperes and below: inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
- D. Electronic Trip Circuit Breakers for circuit breakers 125 amperes and above: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long-and short-time time adjustments
 - 4. Ground-fault pickup level, time delay, and I²t response.
- E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through rating less than NEMA FU1, RK-5.
- F. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles
 - 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

2.04 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250 Type A.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Kitchen and Wash-Down Area: NEMA 250, Type 4X, stainless steel.
 - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION**3.01 APPLICATIONS**

- A. Each piece of equipment utilizing multi-phase power shall be supplied with a safety-type disconnect switch.
- B. Each piece of equipment utilizing single-phase power and protected at over 30 amperes shall be supplied with a safety-type disconnect switch.
- C. Motor disconnects other than mentioned above may utilize a toggle type manual control switch properly sized and rated for the equipment it disconnects.
- D. Factory installed fused disconnect switches may be used to satisfy the above requirements with the Architect's prior approval.

3.02 MOUNTING

- A. Switches or circuit breakers less than 100 pounds may be mounted on the wall. Equipment over 100 pounds shall be mounted on a rack that extends from floor to ceiling. Do not mount switches or circuit breakers to equipment housing.

END OF SECTION

SECTION 265100 – INTERIOR LIGHTING**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section includes, but is not necessarily limited to, the furnishing and installation of all lighting as indicated on the Drawings, as specified herein, and as necessary for the proper and complete performance of the work.
- B. Major items:
 - 1. Interior lighting fixtures
 - 2. Emergency lighting
 - 3. Exit lighting
 - 4. Lamps installed in fixtures
 - 5. Adequate fixture support systems.

1.02 STANDARDS

- A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
 - 1. ANSI-UL Standards
 - a. 924 – Emergency Lighting and Power Equipment
 - b. 935 – Fluorescent Lamp Ballasts
 - c. 1570 – Fluorescent Lighting Fixtures
 - d. 1572 – Incandescent Lighting Fixtures
 - e. 1572 – High Intensity Discharge Fixtures
 - 2. NFPA
 - a. 70 – NEC
 - b. 101 – Life Safety

1.03 FIXTURE SCHEDULE

- A. No substitutions will be accepted after bids are received. The lighting equipment specified herein has been carefully chosen for its ability to meet luminous performance requirements of this project. Substitutions in all likelihood will be unable to meet all of the same criteria as specified equipment. No exceptions.
- B. When only one manufacturer is listed within the description of the luminaire, the design engineering of architectural aesthetics will not allow substitution of another manufacturer. The contractor shall provide a separate list of unit costs for these luminaires with shop drawings. Shop drawings will not be reviewed without unit cost information.
- C. When more than one manufacturer is listed within the description of the luminaire, the design engineering or architectural aesthetics will allow the Contractor to choose one of the manufacturers listed, but no other substitution will be acceptable.
- D. When one or more manufacturers and the words "or equivalent" appear within the fixture description, the Contractor may elect to submit to Engineer a substitute fixture for review. All submittals must be made within 14 days prior to the bid date to provide ample time for review and to issue an addendum incorporating the substitution.
- E. Substitution submittals shall consist of a physical description, dimensioned drawing and complete photometric and electric data of the proposed lamp and luminaire. Working samples of lamp and luminaire substitutions must also be supplied for visual check of finish and operating characteristics. Photometric reports must list the actual candela values for the luminaire's distribution in at least three planes. Candela curves, footcandle and lumen tables and iso-footcandle contours are not acceptable. No substitutions will be considered without compliance with the paragraph. Contractor will be responsible for all cost, (engineering time, manufacturer's costs, distributor costs) incurred to replace equipment not approved if substitutions are made by the distributor, manufacturers representative, or subcontractor.

- F. Once Bids, Shop Drawings are approved, all lighting is to be ordered in a timely manner. The Contractor is then to inform the Engineer immediately, in writing, the date when equipment orders are completed and delivery scheduled.

1.04 SUBMITTALS

- A. Submit shop drawings and manufacturers' data for the following items in accordance with the conditions of the contract and as specified below.
1. Major luminaires and special luminaires shall show full size cross sections. Indicate finished dimensions, metal thicknesses, and materials.
 2. Show mounting details, including hung ceiling construction.
 3. Indicate type of ballast and manufacturer and ballast quantity and location. Include information as to power factor, input watts, and ballast factor.
 4. Shop drawings shall include a complete listing of all luminaires on a single sheet. This listing shall contain the luminaire type, manufacturer's catalog number, applied voltage, lamps and ballasts.
 5. Submit manufacturer's fixtures and accessories Shop Drawings and data in booklet form, including rough-in dimensions, instructions for installation and maintenance.

1.05 PROTECTION

- A. Protect lighting fixtures and work against dirt, water or mechanical damage before, during, and after installation. Damage to fixtures prior to final acceptance shall be repaired or replaced at no cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS AND FIXTURES

- A. General
1. Provide all lighting fixtures in accordance with Lighting Fixture Schedule and as indicated and required on Drawings.
 2. Fixture catalog numbers only indicates type and style. Provide each fixture complete with proper fixture trim, levelers, mounting brackets, flanges, plaster rings, glassware and accessories for complete installation as required for type of ceiling and room finish schedules.
 3. All plastic diffusers used in lighting fixtures shall be manufactured of 100 percent virgin acrylic plastic.
 4. Provide approved fireproof enclosures UL rated (UL 0529) where recessed in fire rated ceilings.
 5. Provide gaskets as required to prevent light spill between frames and ceilings.
 6. Provide "wet" labels on all fixtures installed outdoors or in moist areas.
 7. Provide continuity of ground on all fixtures used as raceways and mounted end to end.
 8. All metal parts to be chemically treated with a rust resistant phosphatized solution, reflecting surfaces to have a factor of minimum 90%.
 9. Provide luminaires, completely factory-assembled and wired and equipped with necessary sockets, ballasts, wiring, shielding, reflectors, channels, lenses, etc., and deliver to job ready for installation.
 10. Parabolic Luminaire Care: Parabolic luminaires to be installed with Mylar cover over louvers. Cover shall be UL listed for temporary lighting. Upon completion of work, remove Mylar cover with white glove and blow clean reflectors.
 11. Finish: Porcelain or baked enamel finish matte white on interiors with minimum test reflectance of 90% matte white finish or as specified in visible exterior. Thoroughly clean base metal and bonderize after fabrication.

12. Sockets: Incandescent lamp socket – porcelain housings over copper screw shells, with medium base sockets rated at 660 watts and 250 volts. Insulating joint in pull chains. Fluorescent lampholder – white, heat-resistant plastic rated 660 watts and 600 volts. Fluorescent industrial sockets – heavy-duty sockets for HID luminaires where mounted less than 8'-0" AFF.
 13. Luminaire Wiring: Minimum individual luminaire wiring – number 18 gauge with insulation with rated operating temperature of 105 degrees Centigrade or higher. Terminate wiring for recessed luminaires, except fluorescent units, in an external splice box.
 14. Recessed incandescent luminaires shall be furnished with thermal protection in accordance with Article 410-65 of the NEC.
 15. Where installed outdoors, in garage areas or in spaces open to the exterior, provide each fluorescent lamp with an OSHA approved tube guard as manufactured by McGill Manufacturing Company. Tube shall have 96% transmission properties.
 16. Where utilized as raceway, luminaires shall be suitable for use as raceways. Provide feed through splice boxes where necessary. Wiring shall be rated for 90 degrees Centigrade.
- B. Lamps:
1. Provide lamps in all fixtures and lamp outlets of proper type voltage and wattage required for fixtures and indicated in Fixture Schedule or as indicated on Drawings.
 2. All fluorescent lamps shall be Philips, Sylvania, or equal by General Electric. All lamps shall be provided by a single manufacturer.
 3. Contractor will provide 10% replacement lamps to the Owner of all lamp types upon completion of the job.
- C. Ballasts (fluorescent and compact fluorescent):
1. All ballasts for T8, T5 and T5 high output lamps shall be of the high frequency electronic type.
 2. Ballast shall carry the UL label for intended use, ETL certification and "A" sound rating, and be equipped with an internal, automatic, resetting thermal protection system (Class "P").
 3. High intensity discharge ballasts shall be constant wattage auto-transformer type with built-in thermal protection unless otherwise specified. Power factor rating for fluorescent and HID ballasts shall be 90% minimum.
 4. Metal halide universal voltage ballasts for 39W, 70W, 100W and 150W lamps shall be electronic type with a power factor greater than 95%, THD,10% ballast factor 1.0, current crest factor of 1.2 and current frequency greater than 130Hz as manufactured by Aromat.
 5. Ballasts shall be manufactured by Motorola, Universal, Advance, or approved equivalent. All ballasts for each lamp type shall be of the same manufacturer.
 6. Fluorescent lamp ballasts shall be high frequency electronic type, instant start-general applications, program rapid start-controlled circuits and T5 lamps, and operating lamps at a frequency of greater than 20 KHZ with no detectable flicker.
 7. Contractor is to replace ballasts that the Architect or occupant states are unduly noisy, at no cost to the Owner.
 8. All remote stepdown transformer shall be properly wired to fixtures so as to completely eliminate voltage drop, regardless of transformer location.
 9. Parallel lamp connection where available.
 10. THD,20%, THD,10% for compact fluorescent.
 11. Current crest factor = 1.7 or less.
 12. Ballast factor of minimum .88.
 13. All electronic ballasts for fluorescent lamps with a diameter of T5 or less shall be provided with shut down circuitry that will interrupt power to the lamp at end of life.
 14. The conductors between ballasts and lampholders shall have an approved insulation for 1000 volts. This includes conductors to and from remote ballasts.

15. Provide universal voltage 120v-10% through 277v + 10%) ballasts.
 16. Ballasts for control of lamps in one housing or fixture shall not control lamps of an adjoining unit, except as otherwise noted.
 17. Dimming ballast shall be certified by the manufacturer for use with specific dimming control system and lamp type specified.
 18. Electronic ballasts including LED drivers shall be covered by a five-year full service warranty for replacement ballast and labor. All other ballasts shall be covered for one full year and one year pro-rated as per standard manufacturer's warranty against defects. Guarantee to include labor for replacing defective ballast with new ballast.
- D. Fusing
1. All HID fixtures shall be completed with a fuse in each phase conductor, located within the fixture.
- E. Emergency Lighting Ballast
1. Emergency lighting systems shall be as indicated in Drawings, complete with all equipment, including fixtures, lamps, batteries, conduit, boxes and wiring.
 2. This equipment is to provide instantaneous emergency lighting in the event of a power failure by means of batteries controlled by solid state controls.
 3. Where indicated on fixture schedule and/or on drawings, provide emergency ballasts in light fixtures. The emergency ballasts shall consist of a high-temperature, maintenance-free nickel-cadmium battery and electronic circuitry contained in a red metal case. A solid-state charging indicator light to monitor the charger and battery, a double-pole test switch, and installation hardware shall be provided. The emergency ballast shall be capable of operating one fluorescent lamp at 1100 to 1400 lumens initial light output in the emergency mode for a minimum of 90 minutes. The ballast shall meet or exceed emergency standards set forth by the NEC and shall be UL listed for installation inside, on top of, or remote from the fixture. It shall be warranted for a full five years from the date of purchase. Ballasts shall be Model B50 as manufactured by Bodine or an approved equal.
- F. Exit Lighting
1. Exit lighting system shall be as indicated on Drawings.
 2. Equipment shall be complete with lamps.
 3. Where indicated as such, provide battery pack and charger for illumination under power failure conditions.
 4. Equipment shall meet BOCA, OSHA, NFPA and NEC illumination standards.

2.02 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: ½ inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.
- C. Twin-Stem Hangers: Two, ½ inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. General
1. Install outlets, surface mounted, recessed or semi-recessed fixtures to maintain the alignment, spacings, layout and general arrangements indicated in the Drawings. Obtain approval of Engineer for all changes in layout required to avoid interferences with other trades.
- B. Coordination
1. Work incorporating with ceiling trades in locating and framing recessed fixtures in acoustical tile pattern or grid system to conform to layout.

2. Inform affected trades of the location and framing details necessary for the installation of flush fixtures and deliver all framing rings of these fixtures that become a part of the ceiling construction.
 3. Before equipment is ordered, electrical contractor to review luminaire and ceiling mechanical compatibility in each area and verify luminaire on the drawings. Contractor shall be responsible for all fixture quantities, lengths and clearances required and shall inform the ARCHITECT of the job conditions at variance with the fixture(s) specified or detailed which affect installation or location. (All stages of installation.)
 4. Mechanical and electrical contractors are to review and coordinate lighting locations in relationship to mechanical systems to minimize conflicts prior to installation. Electrical contractor is to submit a written memo with minutes of these meetings to both the Architect and Engineer.
 5. This contractor is responsible for coordinating the characteristics and the U.L. labeling of the luminaires and their components with the ambient conditions, which will exist when the luminaires are installed. No extra compensation will be permitted for failure to coordinate the luminaires with their ambient conditions.
- C. Mounting and Supports
1. Install luminaires in mechanical and unfinished areas after ductwork and piping installation. Locate fixtures 8 feet 6 inches above the floor, or at suitable locations within space on walls but not lower than 7'-0" AFF. Where mounted lower than 8'-6" luminaires shall be protected by an approved wire guard.
 2. Where fluorescent luminaires are surface mounted, they shall be labeled for such and a minimum of one-half (1/2) inch air space and shall be maintained between top of luminaire and mounting surface by an approved means.
 3. Pendant mounted units shall comply with the following:
 - a. Where luminaires are mounted in a continuous row, luminaires, eight feet in length shall have stems placed within 2'-0" of end of fixture. Stems shall be spaced symmetrically. A fixture, four feet or three feet in length, placed in a row, shall have a stem connected to center luminaire.
 - b. Individual luminaires, four feet in length, shall have two stems placed approximately 3 inches from each end.
 - c. Individual luminaire, three feet in length, shall have dual stems and a single canopy.
 - d. Each stem shall have a brass or steel swivel or other self-aligning device of type approved by the Architect/Engineer.
 4. Where luminaires are mounted on surface-mounted outlet boxes in surface mounted conduit runs, this Contractor shall furnish and install a luminaire canopy sufficiently deep to permit exposed conduits to pass through. Canopy shall have proper openings cut by luminaire manufacturer through which conduits may pass. Submit sample of canopy for approval before installation.
 5. Prior to final payment, this contractor shall clean all luminaires and replace all lamps. He shall also touch up all scratch marks, etc. in an approved manner.
 6. Provide a minimum of two support points for all surface, pendant or recessed mounted luminaires. The supports shall be tied to the building structural system. The support points shall be totally independent of the ceiling system.
 7. Recessed luminaires to be installed in metal panel or acoustic modular ceilings shall be modified as required to fit into openings in ceiling construction. This contractor shall coordinate and verify this work with the General Construction Contractor. Shop Drawings showing details shall be submitted for approval.
 8. All luminaires in hung ceilings are to be installed with earthquake clips.
- D. Emergency Systems Raceway and Hook-up
1. Circuit wiring for the emergency systems shall be installed in separate raceway and kept entirely independent of all other wiring and equipment.
 2. Replace all burned out incandescent and dimmed lamps.

3.02 ADJUSTING AND CLEANING

- A. At project completion, before final approval:
 - 1. Aim adjustable fixtures as directed and observe and adjust at night as required.
 - 2. Clean interior of all fixtures, all lenses and lamps.

END OF SECTION

SECTION 265600 - EXTERIOR LIGHTING**PART 1 - GENERAL****1.01 SUMMARY**

- A. This Section includes the following:
 - 1. Exterior luminaires with lamps and ballasts.
 - 2. Poles and accessories.
- B. See Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

1.02 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports and supporting structure, applied as stated in AASHTO LTS-4.
- B. Ice Load: Load of 3 lbf/sq. ft., applied as stated in AASHTO LTS-4.
- C. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
 - 1. Wind speed for calculating wind load for poles exceeding 50 feet in height is 90 mph.
 - 2. Wind speed for calculating wind load for poles 50 feet or less in height is 70 mph.

1.03 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Include anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. In Lighting Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs, sharp corners, and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. Factory-Applied Finish for Steel luminaires: Color as selected by Architect. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.03 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4.
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
 - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."
- E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
- F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

2.04 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig; 1-piece construction up to 40 feet in height with access handhole in pole wall.
 - 1. Shape: Round, tapered.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

- B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - 3. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- F. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- G. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- H. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
- I. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Color shall be as selected by Architect.

PART 3 - EXECUTION

3.01 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming.

3.02 POLE INSTALLATION

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
 - 1. Fire Hydrants and Storm Drainage Piping: 60 inches.
 - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
 - 3. Trees: 15 feet.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
 - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 - 3. Install base covers, unless otherwise indicated.
 - 4. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

- E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - 1. Dig holes large enough to permit use of tampers in the full depth of hole.
 - 2. Backfill in 6-inch layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.
- F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
 - 1. Make holes 6 inches in diameter larger than pole diameter.
 - 2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi at 28 days, and finish in a dome above finished grade.
 - 3. Use a short piece of 1/2-inch- diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
 - 4. Cure concrete a minimum of 72 hours before performing work on pole.
- G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.
- H. Raise and set poles using web fabric slings (not chain or cable).

3.03 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top 4 inches above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.04 CORROSION PREVENTION

- A. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.05 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole, unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

END OF SECTION