

CSHQA

PROJECT MANUAL

For

THERON W. WARD JUDICIAL BUILDING REMODEL AND EXPANSION

427 Shoshone Street North
Twin Falls, Idaho 83301



Project No. 21403.000

April 21, 2023

SIGNATURE

*We Approve of this Contract Document Set and understand that in accordance with our Design Service Agreement, significant changes resulting more than 4 hours of time to implement requested by us after granting this approval may result in project delays and/or additional design fees.

Dore Hall
Signature/Date

AGENCY REVIEW SET

**SECTION 000107
SEALS PAGE**

OWNER:

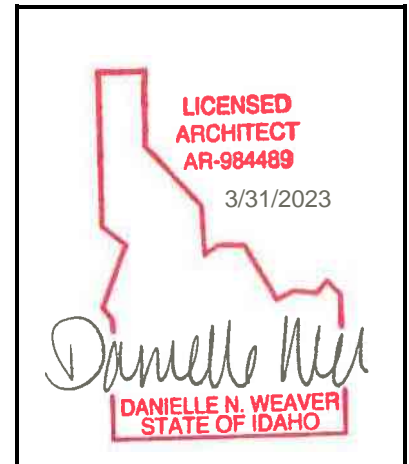
Twin Falls County
630 Addison Avenue West
Twin Falls, Idaho 83303-0126

Bob Beer, Facilities Director
Twin Falls County
County West
630 Addison Avenue West
Twin Falls, Idaho 83303

Starr Corporation
2665 E 3600 N
Twin Falls, Idaho 83301

ARCHITECT:

Danielle N. Weaver, AIA
CSHQA, Inc.
200 West Broad Street
Boise, Idaho 83702
(208) 343-4635, phone
(208) 343-1858, fax
danielle.weaver@cshqa.com
www.cshqa.com



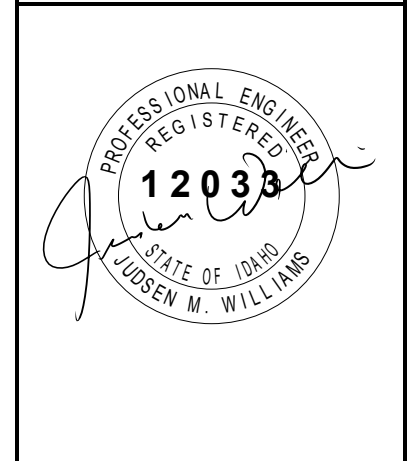
CIVIL
ENGINEER:

Jeff Ward, P.E.
CSHQA, Inc.
200 West Broad Street
Boise, Idaho 83702
(208) 343-4635, phone
(208) 343-1858, fax
jeff.ward@cshqa.com
www.cshqa.com



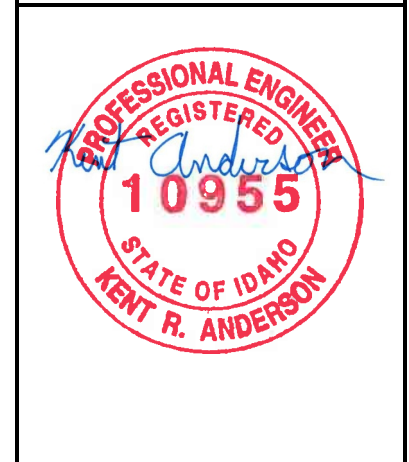
STRUCTURAL
ENGINEER:

Judsen M. Williams, P.E., S.E.
KPFF, Inc.
412 East Parkcenter Boulevard, Suite 200
Boise, Idaho 83706
(208) 336-6985, phone
judsen.williams@kpff.com
www.kpff.com



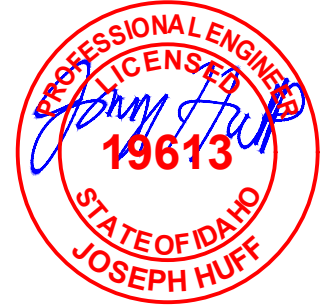
MECHANICAL (PLUMBING)
ENGINEER:

Kent R. Anderson, P.E.
CSHQA, Inc.
200 West Broad Street
Boise, Idaho 83702
(208) 343-4635, phone
(208) 343-1858, fax
kent.anderson@cshqa.com
www.cshqa.com



MECHANICAL (HVAC)
ENGINEER:

Joseph A. Huff, P.E.
CSHQA, Inc.
200 West Broad Street
Boise, Idaho 83702
(208) 343-4635, phone
(208) 343-1858, fax
Joe.huff@cshqa.com
www.cshqa.com



Digitally signed by Joseph Huff
Date: 2023.03.30 14:27:39-06'00'

FIRE PROTECTION
ENGINEER:

Gregory T. Jones, P.E.
Protection Consultants, Inc.
1199 South Main Street, Suite 101
Centerville, Utah 84014
(801) 295-6070, phone
(801) 677-0000, fax
greg@pciut.com
www.pciut.com



ELECTRICAL ENGINEER:

Jason L. Brunson, P.E.
CSHQA, Inc.
200 West Broad Street
Boise, Idaho 83702
(208) 343-4635, phone
(208) 343-1858, fax
jason.brunson@cshqa.com
www.cshqa.com



Jason L. Brunson, P.E.
jason.brunson@cshqa.com
2023.03.30 13:01:45-06'00'

ORIGINAL DOCUMENTS ARE HELD
AT CSHQA, INC. OFFICE, 200 W
BROAD STREET, BOISE, ID 83702

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**SECTION 003100
AVAILABLE PROJECT INFORMATION**

PART 1 GENERAL

1.01 EXISTING CONDITIONS

- A. Certain information relating to existing surface and subsurface conditions is available but will not be part of Contract Documents, as follows:
- B. Geotechnical Report: A geotechnical investigation at the project site has been performed and information from the investigation is contained in a report entitled "Geotechnical Engineering Evaluation Report," dated August 3, 2022, prepared by Strata of Boise, Idaho.
 - 1. A copy of this report appended to this Section.
 - 2. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of the Architect.
 - 3. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in Contract Documents.
 - 4. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Sum accruing to Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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August 3, 2022
File: TF21169B

Mr. Bob Beer
Twin Falls County Planning
630 Addison Ave W
Twin Falls, Idaho 83301
Bob.beer@tfco.org
(208) 358-1150

RE: Geotechnical Engineering Evaluation Report
Theron W. Ward Judicial Building Remodel
and Expansion with Public Health, Safety
and Technological Upgrades to Prevent or
Control the Spread of Infectious Disease
Twin Falls, Idaho

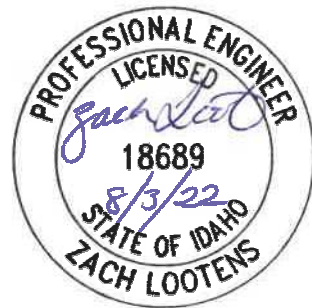
Dear Bob:

STRATA has prepared this report summarizing our geotechnical engineering evaluation for the proposed remodel and expansion at the Theron W. Ward Judicial Building in Twin Falls, Idaho. The purpose of our geotechnical engineering evaluation was to explore subsurface soil conditions and provide recommendations for foundation and pavement design along with construction recommendations for the proposed structure. We accomplished our services in accordance with our general contract (File: TFP21169B), authorized on April 18, 2022.

The site is underlain by limited uncontrolled fill and collapsible loess silt. Soil improvements, as outlined in this report will be required to remediate these conditions to provide support for the planned development. Excavation for the proposed basement will likely require rock excavation in basalt.

This report summarizes our field evaluation, subsurface characterization, and recommendations for earthwork, foundation design, pavement design, drainage, and construction. Portions of this report cannot be relied upon individually without the supporting text of remaining sections, appendices, and/or plates. When providing this report to designers, estimators, contractors, etc., the report including all plates, appendices, and attachments must be provided in its entirety.

We appreciate the opportunity to work with Twin Falls County on this project. Please contact us if you have any questions or comments.



Sincerely,
STRATA

Jacob A. Helms
Jacob Helms, E.I.
Staff Engineer

Zach Lootens, P.E.
Project Engineer

Daniel P. Gado
Dan Gado, P.E.
Senior Engineer

JH/ZL/DPG/kb

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Geotechnical Engineering Evaluation Report

Theron W. Ward Judicial Building Remodel and Expansion with Public Health, Safety and Technological Upgrades to Prevent or Control the Spread of Infectious Disease
Twin Falls, Idaho

INTRODUCTION

STRATA is pleased to provide our geotechnical engineering evaluation for the proposed remodel and expansion of the Theron W. Ward Judicial Building at 427 Shoshone St. N in Twin Falls, Idaho. The project location is illustrated on Plate 1, *Exploration Location Plan*. The purpose of our evaluation was to provide earthwork, foundation and pavement design, drainage, and construction recommendations for the proposed development. We accomplished our services in accordance with our general contract (File: TFP21169B), authorized on April 18, 2022.

PROJECT UNDERSTANDING

Site Description

The project site consists of approximately three quarters of acre of the northeast corner of the Twin Falls Courthouse campus and is located on the current the lawn and historical rose garden. The topography of the site is relatively level with 1 to 2 feet of relief from the northwest to the southeast.

Proposed Construction

We understand the proposed development includes the remodeling of the existing courthouse, as well as a significant building expansion to the northeast. The building expansion will be an approximately 33-foot-tall, 2 story traditional steel construction with concrete footings and a masonry veneer and glass exterior finish. A partial basement is to be constructed below the expansion, with an anticipated finish floor elevation of 12 feet below grade. The basement will connect to the existing jail to transfer inmates to the courtrooms. Wall and column loads are unknown at this time but are estimated to be up to 100 to 150 kip column loads and 6 to 8 kip/ft (klf) wall loads. A grading plan has not been provided at this time; however, we expect cut and fill depths less than 2 feet. A passenger vehicle parking area paved with Hot Mix Asphalt (HMA) flexible pavement is planned between the northeast limits of the expansion and 6th Ave.

SUBSURFACE EXPLORATION

We performed our subsurface exploration on April 19th, 2022, by observing the excavation of test pits to a maximum depth of 10.5 feet below the existing ground surface throughout the site. The excavations were performed by the County using a Case 580 backhoe. The approximate locations of the test pits are illustrated on Plate 1, *Exploration Location Plan*.

A geotechnical engineer from our office visually evaluated the soil/rock encountered at the test pit locations and logged the subsurface profiles in accordance with the Unified Soil Classification System (USCS) Manual-Visual method. We obtained soil samples in each stratum encountered in the test pits. At the conclusion of our subsurface investigation, the test pits were backfilled with the excavation spoils, tamped with the bucket to roughly match the existing surface.

The test pit locations were recorded in the field using a hand-held GPS unit, accurate to ± 15 feet. A brief explanation of the USCS for use in interpreting the terms on the logs is included with the test pit logs in Appendix A.

SITE GEOLOGIC SETTING

Regional Geology

The project site is located in Twin Falls, Idaho, within the Upper Snake River Plain. The geology in the general vicinity of the site consists of younger windblown soil deposits (loess) and older cemented loess with a thick caliche horizon overlying Basalt of Stricker Butte. The Basalt of



Stricker Butte was deposited during the Pleistocene or Pliocene Epochs (Othberg et al., 2005). The basalt rock is described as medium to coarse-grained and reddish-brown to dark gray/black in color.

SUBSURFACE CONDITIONS

Subsurface soil/rock conditions encountered in the test pits generally consisted of Sandy Silt (ML) fill underlain by wind-blown Silt (ML) or Silty Sand (SM) (loess), underlain by strongly-cemented silty sand (caliche), then basalt. Undocumented fill was identified in all 6 test pits to a maximum depth of 5.0 feet. The fill was classified as Sandy Silt (ML) in all test pits except TP-2, which contained Silt with Sand (ML). This undocumented fill was brown, moist, firm to stiff, and contained caliche particles and organics. Based on the County's understanding of the site history, undocumented fill areas with significant thicknesses are only expected along the perimeter of the fence outside of the jail. The undocumented fill encountered in TP-1, TP-3, and TP-5 may be isolated to disturbed soils in the rose garden area, whereas the County expects the subsurface below the existing lawn to be native soils.

Native loess classifying as Silty Clay (CL-ML) was encountered in test pits TP-3, TP-4, and TP-5 beneath the undocumented fill. This layer was generally approximately 6-inches-thick when encountered and was moist, firm to stiff, variably cemented, and either tan or brown.

Loess classifying as Silt, Silt with Sand, Sandy Silt (ML), and Silty Sand (SM) was encountered beneath the fill or silty clay in all test pits and extended a maximum depth of 10 feet before encountering caliche. The silt was observed to be stiff to hard with varying degrees of cementation. The silty sand was medium dense to dense where encountered and also exhibited varying degrees of cementation. The degree of cementation generally increased with depth.

A strongly cemented Silty Sand (SM) (caliche) layer was observed below the younger, native loess and three of the six (TP-1, TP-2, and TP-6) of the test pits were terminated in this layer due to practical backhoe refusal. This layer is very dense and has the consistency of soft rock.

Basalt was encountered in test pits TP-3, TP-4, and TP-5 at depths of 8.0, 10.0, and 7.5 feet respectively. The basalt appeared to be hard and should be considered non-excavatable with typical soil excavation equipment. The depth to rock is shown on Plate 1.

Specific soil and rock contacts and descriptions are included on the test pit logs in Appendix A.

Groundwater was not encountered in any of the test pits at the time of our subsurface explorations. Based on our review of Idaho Department of Water Resources (IDWR) well-driller logs in the area of the project, the depth to groundwater is expected to be between 25 to 45 feet below the surface and is located within the fractured/vesicular basalt. We anticipate that groundwater levels will fluctuate seasonally and in response to local irrigation practices and precipitation events. Perched groundwater may be present at soil-rock interfaces.

LABORATORY TESTING

Soil samples collected from the test pits were returned to our laboratory for further classification and testing. Laboratory testing was accomplished in general accordance with ASTM International (ASTM) procedures. ("General accordance" means that certain local and common descriptive practices and methodologies have been followed.) Our laboratory testing program included:

- Moisture Content (ASTM D2216)
- Percent Passing the No. 200 Sieve (ASTM D1140)
- One-dimensional Collapse Consolidation (ASTM D4546)



Laboratory test results are included on the test pit logs in Appendix A, and presented in Appendix B.

OPINIONS AND RECOMMENDATIONS

General

At this time, wall and column loads are unknown and have been assumed to be maximum 150 kip column loads and 8 klf wall loads. We understand that the structure will consist of a traditional steel construction with continuous wall/strip footings and column spread footings, with concrete slab-on-grade floors. A partial basement with an underground passage to the jail is also planned.

Geotechnical Constraints

Collapsible Silt

The site is underlain by compressible/collapsible silt with varying sand content to depths up to 10 feet below existing grade. This soil exhibits collapse-consolidation when loaded and then subjected to an increased moisture content. Collapse potential was measured in the laboratory via collapse-consolidation testing. After water inundation, 0.4 and 1.5 percent collapse were observed under loads of 2,000 and 1,500 psf at 22-STR-TP03 @ 4-4.5' and 22-STR-TP04 @ 5-5.5', respectively. As a result, settlement of the proposed structure may occur due to soil collapse from infiltration of water in the underlying silt. We recommend soil improvements, such as partially over-excavating the collapsible soils beneath foundations and replacement with structural fill to mitigate the potential of collapsible settlement and reduce the risk of damage to the overlying structure.

Undocumented Fill

Undocumented fill was encountered in all 6 test pit locations to a maximum depth of 5.0 feet. Undocumented fill poses a settlement and bearing capacity risk due to the variation in composition and compaction/strength, and the potential of deleterious materials such as organics or other degradable substances. Due to these risks, the standard of practice is to remove the undocumented fill beneath proposed structure by over-excavating and replacing it with structural fill to mitigate differential settlement or low bearing capacity potential.

Rock Excavation

We understand the finished floor for the partial basement will be approximately 12 feet below existing grade. We expect excavation for the basement foundation will require rock excavation, which will likely require splitting, blasting, or excavator mounted hydraulic hammers to achieve construction grades. Basalt was encountered in test pits 22-STR-TP03 at 8 feet, 22-STR-TP04 at 10 feet, and 22-STR-TP05 at 7.6 feet. The remaining test pits were terminated in very strongly cemented loess (caliche), which overlies basalt and is typically only a few (1 to 2) feet thick.

Earthwork

Excavation Characteristics

Based on our exploration results, it is our opinion that the near surface soil at the project site may be excavated with conventional earthwork equipment; however, we anticipate that excavations made within the caliche may require equipment capable of rock excavation including ripper teeth or a rock excavation bucket. Excavations in basalt will likely require pneumatic hammers or drilling and blasting.

Excavations may cave and slough and are to be sloped in accordance with Occupational Health and Safety Act (OSHA) guidelines. Based on our test pits, the upper silt (loess) on the site



corresponds to an OSHA Class B soil and undocumented fill should be classified as Class C. Excavations in these soils should be temporarily sloped no steeper than 1H:1V (horizontal to vertical) for excavations deeper than 4 feet for Class B soils and 1.5H:1V for Class C. Caliche can stand vertically, but it is susceptible to breaking down when wet; therefore, we recommend sloping caliche as Class A soil excavated at slopes no steeper than 0.5H:1V. Basalt can likely be considered stable rock, however the stability of rock masses depend on the degree of fracturing and the orientation of the discontinuities, and thus need to be evaluated on a case-by-case basis. We recommend earthwork contractors evaluate each excavation configuration specific to OSHA guidelines and that they seek appropriate professional guidance to ensure excavation safety and stability. Construction vibrations can cause excavations to slough or cave and should be considered by the contractor during daily task planning. Surcharges must not be allowed within a horizontal distance equal to one-half the excavation depth. Ultimately, the contractor is solely responsible for site safety and excavation configurations.

Clearing/Stripping

We observed 8 to 15 inches of organic rich soil with roots (topsoil) at the site. Topsoil present within the construction area is not suitable and cannot be allowed to remain as subgrade. We recommend stripping the topsoil below any proposed building and pavement structures. Deeper grubbing may be required within the rose garden.

Site and Subgrade Preparation

Foundation Areas

Following clearing and stripping, foundation excavations should be performed for subgrade soil improvement to the recommended depths in Table 1 below. The over excavation should extend a minimum of 1/2 foot beyond the edge of the footing in all directions for every foot of over excavation below footing subgrade. The over excavation is referenced to the elevation of the bottom of the footing. Over excavations should remove non-cemented and weakly cemented loess which displayed high strains at design loads in consolidation test data. The over excavations may be terminated prior to depths in Table 1 if the underlying moderately cemented loess with a pocket penetrometer reading of 3.0 or higher is encountered as identified by the Geotechnical Engineer. At this time grading plans and finished floor elevations are not available. If fill placement is required, the over excavation depths below footings in Table 1 shall be increased by the positive increase in grade change from existing ground.

Foundation excavations should be accomplished with a smooth blade backhoe to mitigate disturbance of the underlying moisture sensitive silty soil or else proof compacted using a vibratory hoe pack. All loose or frozen soil or water at the base of foundation excavations should be removed. Over excavations should be backfilled to the bottom of footing with Granular Structural Fill. Undocumented fill or other degradable materials below strip or spread footing foundations should be removed to the native soil and replaced with Granular Structural Fill.



Table 1. Foundation Subgrade Soil Improvement Recommendations		
Foundation Type	Depth of Over Excavation *	Minimum Embedment (ft)**
Continuous/Strip	2-ft	2
Column/Spread	3-ft	2

*Over excavation in reference to bottom of footing/slab elevation. In areas where the finished grade is higher than the existing grade, the over excavation depths shall increase by the difference in positive grade change.

**Embedment depth in reference to finished grade

Floor Slab and Pavement Areas

As previously mentioned, up to five feet of undocumented fill was encountered; however, based on discussions with the County we expect the undocumented fill will mostly be confined to the perimeter along the jail fence and within the rose garden area. We recommend removing undocumented fill below slab and pavement areas and replacing with General Structural Fill.

Following clearing and stripping and over-excavation of undocumented fill, the exposed subgrade below all floor slab and pavement areas should be moisture conditioned and proof compacted with 5 passes of a 5-ton vibratory roller or a vibratory hoe pack. A steel probe or proof roll shall be used to verify subgrade stability. Subgrade soils that rut or weave under the compaction equipment, appear to contain significant organics, or soft spot areas identified with steel probing should be undercut and replaced with compacted Granular Structural Fill.

Care should be taken during seasonally wet construction periods so that compaction operations do not excessively disturb the subgrade. It is the contractor's responsibility to ensure that the prepared subgrade is not damaged prior to placing structural fill.

Wet Weather/Soil Construction

We recommend earthwork be performed during dry weather conditions. Fine-grained, silty, and clayey soil is susceptible to pumping and/or rutting when the soil is above optimum moisture content and subjected to heavy loads, such as rubber-tired equipment or vehicles. Earthwork should not be performed immediately after precipitation events until the soil has dried sufficiently to support construction traffic without disturbing the subgrade. The contractor shall take precautions to protect the subgrade from becoming saturated and/or disturbed. We recommend the contractor limit construction traffic on prepared subgrade and reduce exposure of the subgrade to precipitation and water. Specifically, the contractor should:

- Slope subgrades to direct surface water away from construction areas.
- Remove subgrade soil that has become soft and/or pumping and replace it with properly compacted structural fill, as described in the *Structural Fill* subsection below.
- Not place structural fill during or immediately following a significant precipitation event.
- Not place structural fill on frozen or saturated subgrades.

Use of on-site silty soil as structural fill may be impractical during periods of inclement weather. Therefore, we recommend construction contingencies include removal and replacement of wet soil with imported Granular Structural fill.



Utility Trench Construction

Trenches for utilities should conform to the specifications of the Idaho Standards for Public Works Construction (ISPWC) Section 305 and 306 (ISPWC 2017) with City of Twin Falls modifications (Fields, 2019). Trench backfill below the building footprint should be imported trench backfill per Section 306.2.3 compacted to Type A-1 compaction or be placed as flowable fill (300 psi) per Section 703. Loose soil must be removed from the base of trenches prior to placing utility trench bedding. In addition, if water is encountered, it must be removed from the base of the trench before placing bedding.

Structural Fill

All fill placed for the development must be placed as structural fill. The on-site silt with varying sand content can be reused as General Structural Fill provided it is moisture conditioned to near optimum moisture content for compaction. The on-site silt is moisture sensitive and can be difficult to reuse during inclement weather. In general, the structural fill requirements described on the following page correlate to ISPWC Specifications.

Table 2. Structural Fill Specifications and Allowable Use	
Structural Fill Material • Allowable Use	Material Specifications
General Structural Fill • General Site Grading	<ul style="list-style-type: none"> • Soil classified as GW, GP, GW-GM, GP-GM, GM, GC, SW, SP, SP-SM, SM, SC, or ML according to the USCS. • Maximum particle size must be less than 6 inches. • Soil consisting of inert earth materials with less than 3 percent organics or other deleterious substances (wood, metal, plastic, waste, etc.).
Granular Structural Fill • Soil Improvements • Over Excavations	<ul style="list-style-type: none"> • Soil classified as GW, GP, GP-GM, GW-GM, according to the USCS. • Soil meeting requirements stated in the latest edition of the <i>ISPWC, Section 801 – 6 inch minus Uncrushed Aggregates</i>.
Aggregate Base Course • Pavement Base • Slab on Grade Pad	<ul style="list-style-type: none"> • Soil meeting requirements stated in the latest edition of the <i>ISPWC Section 802 – Crushed Aggregates for Base Type I</i>.
Aggregate Subbase Course • Pavement Subbase	<ul style="list-style-type: none"> • Soil meeting requirements stated in the latest edition of the <i>ISPWC Section 801 – Uncrushed Aggregates, 6 inches or 3 inches</i>
Utility Trench Bedding • Utility Trench Construction	<ul style="list-style-type: none"> • Soil meeting requirements stated in the latest edition of the <i>ISPWC, Section 305 – Pipe Bedding</i>.

The following soils are considered unsatisfactory for use as structural fill, but may be used as non-structural fill in landscape areas:

- Soil classified as CL, CH, MH, OH, OL or PT.
- Soil with a moisture content greater than 3 percent of optimum moisture.



- Any soil containing more than 3 percent organics by weight or other deleterious substances (wood, metal, plastic, waste, etc.).

Compaction

All structural fill should be compacted to a minimum of 95 percent of the maximum dry density of the soil as determined by ASTM D1557 (Modified Proctor). Structural Fill must be moisture-conditioned to near optimum moisture content, placed in maximum 8-inch-thick loose lifts for fine grain cohesive soils and 12-inch-thick lifts for granular soils, and compacted using appropriate compaction equipment. If smaller or lighter compaction equipment is used, the lift thickness should be reduced to meet the compaction requirements.

Fill placed outside the site improvement area can be placed as non-structural fill (i.e. landscape fill) providing there are no structures or pavement planned directly above the landscape fill. We recommend landscape fill be compacted to a minimum of 85 percent of the maximum dry density of the soil as determined by ASTM D1557.

Density testing should be performed at a minimum frequency of one test per lift of structural fill placed below column/spread footings and one test per lift for every 50 feet of continuous/strip footings. Density testing for slabs-on-grade should be performed on the single lift of structural fill at a frequency of 1 test per 2,500 square feet.

Geosynthetics

Geosynthetic applications, although not explicitly required, may increase construction efficiency. Geosynthetic applications are particularly useful in over-excavation situations where, through unsuitable soil or poor construction practices, over-excavation and replacement with structural fill is required. Pumping, rutting, or otherwise soft subgrades may be over excavated a minimum of 1 foot over the soft spot area plus 18 inches laterally in each direction, then a geosynthetic fabric placed at the base of the excavation and the excavation backfilled with Granular Structural Fill. These over excavations may help remediate soft or otherwise degraded subgrades. When applied, geosynthetic roll strips should be overlapped at least 12 inches.

Following subgrade preparations per the *Site and Subgrade Preparation* sections, geosynthetics may be required for areas with soft or wet subgrade. We recommend using a woven geotextile (such as Mirafi HP270) for this application with the minimum properties of 1,000 pounds/ft (tensile strength at 5% strain, ASTM D4595) or 500 pounds (puncture resistance (ASTM D6241) and 250 pounds (Grab Tensile Strength, ASTM D4632).

For drainage applications, we recommend using a non-woven needle punched geotextile (such as Mirafi 140NL) with the minimum properties of 90 lb. (grab tensile strength ASTM D4632), 250 lb. (CBR punch strength ASTM D6241), 2 sec⁻¹ (permeability ASTM D4491) and 145 gal/min/ft² (flow rate ASTM D4491).

Foundations

As previously mentioned, soil improvement will be required to limit the estimated settlement to tolerable levels (assumed to be 1 inch of total settlement and ½ inch of differential settlement between columns). It is our opinion that shallow foundations are suitable for this project; however, there is potential for differential movement in excess of the assumed tolerance at the interface between basement wall footings supporting loading from above ground walls bearing on rock and the adjacent strip/spread footings outside of the basement footprint supported on improved soils. The structural design should include flexible joints that allow for differential movement of up to one inch at these locations.



Shallow Foundations

Shallow foundations can be designed using parameters below in Table 3.

Table 3. Shallow Foundation Design Parameters			
Footing Type	Net Allowable Bearing Pressure (psf)	Sliding Coefficient*	Allowable Passive Earth Pressure (psf)
Ground Level Footings	3,000	0.55	250
Basement Level Footings	6,000	0.70	

We recommend STRATA be retained to observe the foundation installation, including reviewing subgrade and structural fill compaction prior to setting concrete forms or placing concrete. Reviewing the soil improvement process and final foundation bearing surfaces allows us to confirm our assumptions and recommendations and is an important part of the geotechnical design process.

Exterior footings exposed to freezing temperatures must extend at least 24 inches (per Idaho Associate of Building Officials) below the final exterior ground surface to help protect against frost action. Interior foundations that will not be exposed to freezing conditions, must extend at least 18 inches below final slab-bearing elevations and maintain at least 4 inches of gravel between slabs and the top of the footing to reduce the reflective cracking potential. Foundations must be structurally designed to conform to the latest edition of the *International Building Code (IBC)*. The foundation bearing pressure presented above may be increased 30 percent to account for transitory live loads such as seismic and wind. In our opinion, long-term live loads such as equipment, fixtures, etc. should be considered in the total dead loads for the structure.

Concrete Slab-on-Grade Floors

Concrete slab-on-grade floors should be supported by a minimum of 6 inches of Aggregate Base Course placed on a prepared subgrade, as described in the *Site and Subgrade Preparation* section above. Floor slabs can be designed considering a preliminary modulus of subgrade reaction “k” value of 30 psi/in, which is estimated based on the expected settlement response for a 150 psf floor load.

Interior floor slabs may be susceptible to moisture migration caused by capillary action and vapor pressure. We strongly encourage a vapor retarder be installed in areas with floor coverings such as tile, vinyl, or other “impervious coatings”. In areas where no floor coverings are expected, a vapor retarder may not be necessary, and should be evaluated by the owner and the design team. Where utilized, vapor retarders should consist of a 15-mil, puncture resistant sheeting consistent with American Concrete Institute (ACI) Section 302.2R-06 specifications. An example of a common vapor retarder is Stego Wrap™, a 15-mil vapor retarder.

The specific placement location of vapor retarders has been widely discussed in the architectural, structural, construction and geotechnical engineering community, and differing opinions exist. However, current recommendations by the ACI recommend placement of a vapor retarder directly below the concrete slab. Ultimately, the location of the vapor retarder (if a vapor retarder is specified) should be carefully considered by the owner and architect. Studies have shown that decreased concrete water-cement ratios, higher strength concrete, and good construction



finishing practices significantly decrease any negative impacts associated with vapor retarder placement location.

Below-Grade Levels

Below-grade levels must be designed to resist lateral earth pressure. We recommend lateral earth pressure be estimated using equivalent fluid pressures (EFP) from Table 4, assuming on-site Granular Structural backfill and permanent wall drainage will be provided. A 4-inch diameter perforated pipe encapsulated in a drainage geotextile should be placed on the outside perimeter of the basement wall foundation within the Granular Structural Fill backfill and should be connected to a sump/pump system located exterior of the basement wall via a manhole access. The Granular Structural Fill should be placed behind the walls within the wedge bound by the finished surface and a line extending from the bottom of the wall at a 45 degree angle, at a minimum. Basement walls are typically considered as braced at the top and should be designed for at-rest earth pressures.

Table 4: Static Equivalent Fluid Pressure (Drained Conditions)	
Lateral Earth Pressure Case	Equivalent Fluid Pressure (EFP), pcf
At rest case (No wall movement)	60
Active case (Wall movement away from soil mass)	40
Passive case (Wall movement toward soil mass)	300

*pcf = pounds per cubic foot

Seismic Design Criteria

Based on our subsurface test pits, geologic data, the project location, and ASCE 7 (ASCE, 2016), we recommend Seismic Site Class C be utilized for seismic design of the project. Seismic response criteria are presented in the table below. Based on our evaluation, it is our opinion that the potential for liquefaction, fault rupture, and lateral spreading at the project site is low.

Table 5. Seismic Response Criteria			
Period (seconds)	Mapped Acceleration Coefficients (g)	Site Factor for Site Class C	Modified Acceleration Coefficient for Site Class C (g)
0.0 (Peak)	PGA = 0.085	$F_{PGA} = 1.3$	$PGA_M = 0.11$
0.2 (Short)	$S_S = 0.193$	$F_a = 1.3$	$S_{DS} = 0.167$
1.0	$S_1 = 0.082$	$F_v = 1.5$	$S_{D1} = 0.082$



Flexible Asphalt Pavement Section

The development will include a relatively small parking area to be located in the northeast corner of the site. We anticipate truck traffic will be relatively low and traffic will primarily consist of passenger vehicles. We anticipate the pavement subgrade will consist of compacted silt. The recommended flexible hot-mix asphalt (HMA) pavement sections for the development are presented in the table below.

Table 6. Flexible HMA Pavement Sections			
Pavement Section	HMA (inches)	Aggregate Base (inches)	Granular Subbase (inches)
Access Lanes/Parking Lot	2.5	4	8*

*Aggregate Base may be substituted for Granular Subbase

We recommend the pavement section consist of the following:

- Superpave HMA Class SP-3 or SP-2 with PG 64-28 and 1/2-inch nominal aggregate
- Aggregate Base Course (Table 2)
- Aggregate Subbase Course (Table 2)

If the pavement subgrade is wet at the time of construction, we recommend placement of a subgrade separation geotextile over the subgrade soil. The geotextile shall meet Type II requirements (Section 2050.2.3) of the ISPWC. The subgrade separation geotextile should be placed over the subgrade, as described in the ISPWC, prior to placement of the subbase.

Site Surface Drainage

We understand that grading around the proposed remodel and expansion will be minimal. We recommend that finish grades be sloped at a minimum of 5 percent away from the proposed structures for a minimum distance of 10 feet and directed to an acceptable collection area/facility. We have assumed a maximum depth of wetting of 5 ft below the surface due to precipitation and irrigation. Water that is allowed to pond next to structures may extend the wetting front beyond 5 ft, and cause collapse settlement which exceeds our estimate of 1 inch. A 5 percent slope away from the proposed structures will reduce this risk.

At this time, we understand that stormwater runoff will either be directed into an existing facility on the northeast side of the jail or a new site southeast of the Twin Falls Sheriff's Office in the lawn. We recommend maintaining a minimum 30-foot horizontal buffer distance between the perimeter of the new basement addition and subsurface infiltration facilities. Design of subsurface infiltration facilities was not considered for this project. We recommend performing field infiltration testing during construction if a new stormwater infiltration facility is required.

ADDITIONAL RECOMMENDED SERVICES

Once design plans for grading, storm drainage, basement configuration, structural loading are developed, STRATA should be contacted to review this information with the design team and update our geotechnical recommendations, as necessary. Geotechnical engineering design continuity will be an important aspect of this project's successful completion. In our opinion, geotechnical continuity occurs in the planning, design and construction project aspects. Specifically, we recommend STRATA maintain the geotechnical design continuity in the following aspects:



- **Plan and Specification Review:** We recommend STRATA be retained to review final design and construction plans and specifications to verify our geotechnical engineering recommendations have been incorporated into the project documents.
- **Design Confirmation:** We recommend STRATA be retained to provide geotechnical engineering oversight during site grading, soil improvement and excavation to observe the soil conditions and confirm our recommendations for foundation and pavement design and construction.
- **Construction Observation and Testing:** We recommend STRATA be retained to observe foundation excavation and concrete placement operations for shallow foundations. Having STRATA provide inspection and oversight during this process will reduce the potential for unforeseen construction errors which may ultimately impact the project. We can also provide construction material testing and special inspection for reinforced concrete, masonry, reinforcement, and asphalt. If we are not retained to perform the recommended services, we cannot be responsible for related construction errors or omissions.

EVALUATION LIMITATIONS

This report has been prepared to assist with project planning, design and construction of the proposed remodel and expansion of the Theron W. Ward Judicial Building in Twin Falls, Idaho. Our geotechnical findings and opinions have been developed based on our subsurface exploration, laboratory testing, and engineering analysis, as well as our understanding of the project at this time.

Subsurface variations may exist between exploration locations and may not be apparent until construction. Test pits only allow us to observe a portion of the site subsurface conditions. Where such variations exist, they may impact opinions and recommendations presented in this report, as well as construction timing and costs. Our services consist of professional opinions and findings made in accordance with generally accepted geotechnical engineering principles and practices in southern Idaho at the time of this report. The geotechnical engineering recommendations provided herein are based on the premise that appropriate geotechnical engineering consultation during subsequent design phases will be implemented and that an adequate program of testing and observations will be conducted by STRATA during construction to confirm conditions between exploration locations and to verify compliance with our recommendations. This acknowledgment is in lieu of all warranties either express or implied.

This report has been prepared specifically for Twin Falls County and their design team. STRATA cannot be held responsible for unauthorized duplication or reliance upon this report or its contents without written authorization.



The following plate and appendices accompany and complete this report:

Plate 1: Exploration Location Plan

Appendix A: Unified Soil Classification System (USCS), Rock Descriptive Terms and
Exploratory Test Pit Logs

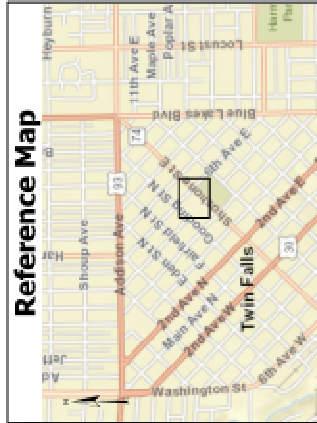
Appendix B: Laboratory Test Results



REFERENCES

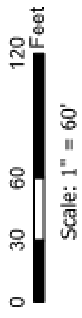
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- ISPWC. (2017). “IDAHO STANDARDS for PUBLIC WORKS CONSTRUCTION, 2017 Edition”. Local Highway Technical Assistance Council (LHTAC), Boise, Idaho.
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Legend

- 22-STR-TP1 Approximate location of test pit observed by STRATA on May 24, 2022
- R Depth to Rock
- NR No Rock Found



EXPLORATION LOCATION PLAN
Theron W. Ward Remodel and
Expansion
Twin Falls, Idaho

Client: Twin Falls County
Client File No.: N/A
Drawn By: G. Jordan
Date: 6/9/2022
File No.: TF21169B
Checked By: Z. Loobergs
Plate 1

Path: C:\Users\moran\Dropbox (STRATA)\Twin Falls\Server\Client\Twin Falls\TF21169B - Theron W Ward Remodel & Exp\CAD & GIS\TF21169B - ELP\TF21169B - ELP.aprx
 Notes: Microsoft; Bureau of Land Management; Esri; HERE; Garmin; GeoTechnologies, Inc.; NGA; USGS

Appendix A

**Unified Soil Classification System (USCS),
Rock Descriptive Terms and Exploratory
Test Pit Logs**

UNIFIED SOIL CLASSIFICATION SYSTEM

SHORTHAND NOTATION

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL NAMES
COARSE GRAINED SOIL MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVELS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	SANDS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS
	SANDS WITH FINES		SM	SILTY SANDS, SAND-SILT MIXTURES	
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	
FINE GRAINED SOIL MORE THAN 50% PASSING NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	INORGANIC		ML	INORGANIC SILTS, SANDY OR CLAYEY SILTS
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, SANDY OR SILTY CLAYS
		ORGANIC		OL	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT 50 OR MORE	INORGANIC		MH	INORGANIC SILTS, MICACEOUS SILTS, PLASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		ORGANIC		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY
HIGHLY ORGANIC SOILS				PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOIL

- SPT - STANDARD PENETRATION TEST
- PL - PLASTIC LIMIT
- LL - LIQUID LIMIT
- PI - PLASTICITY INDEX
- MC - MOISTURE CONTENT
- DD - DRY DENSITY
- WD - WET DENSITY
- UC - UNCONFINED COMPRESSION
- OC - ORGANIC CONTENT
- BGS - BELOW GROUND SURFACE
- N.E. - NOT ENCOUNTERED

MATERIAL DESCRIPTION CONTACT

- DISTINCT SOIL LAYER CONTACT WITHIN SOIL PROFILE
- APPROXIMATE SOIL LAYER CONTACT WITHIN SOIL PROFILE

NOTES

- MIXED UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS ARE USED TO INDICATE DUAL SOIL CLASSIFICATIONS
- THE SPT N-VALUE, REPORTED IN BLOWS PER FOOT, IS THE SUM OF THE NUMBER OF BLOWS REQUIRED TO DRIVE THE STANDARD SPLIT SPOON SAMPLER A DISTANCE OF 12 INCHES AFTER AN INITIAL 6-INCHES OF PENETRATION. IF A TOTAL OF 50 BLOWS ARE INSUFFICIENT TO ADVANCE ANY OF THE THREE 6-INCH INTERVALS, THE PENETRATION DEPTH AFTER 50 BLOWS IS ALSO REPORTED.
- N-VALUES OBTAINED WHILE USING THE MODIFIED CALIFORNIA SAMPLER ARE NORMALIZED TO SPT N-VALUES USING A MODIFICATION FACTOR.

BORING LOG SYMBOLS

GRAPH SYMBOL	DESCRIPTION
	STANDARD 2-INCH OUTSIDE DIAMETER SPLIT-SPOON SAMPLER
	MODIFIED CALIFORNIA 3-INCH OUTSIDE DIAMETER SAMPLER
	ROCK CORE
	SHELBY TUBE 3-INCH OUTSIDE DIAMETER SAMPLER

ADDITIONAL MATERIAL SYMBOLS

GRAPH SYMBOL	LETTER SYMBOL	TYPICAL NAMES
	AC	ASPHALT CONCRETE
	CC	CEMENT CONCRETE
	TS	TOPSOIL
	FL	FILL

TEST PIT LOG SYMBOLS

GRAPH SYMBOL	DESCRIPTION
	BAGGIE SAMPLE
	BULK SAMPLE
	RING SAMPLE

GROUNDWATER SYMBOLS

GRAPH SYMBOL	DESCRIPTION
	GROUNDWATER LEVEL AT TIME OF DRILLING
	GROUNDWATER LEVEL AT END OF DRILLING
	GROUNDWATER LEVEL 24 HOURS AFTER DRILLING COMPLETION
04-10-18	DATE OF GROUNDWATER READING

EXPLORATION LOG KEY SOIL



TERMS TO DESCRIBE ROCK STRENGTH (ISRM, 1981)

GRADE (DESCRIPTION)	FIELD IDENTIFICATION	APPROXIMATE UNIAXIAL COMPRESSIVE STRENGTH (PSI)
R0 (EXTREMELY WEAK ROCK)	CAN BE INDENTED BY THUMBNAIL	35 - 150
R1 (VERY WEAK ROCK)	CAN BE PEELED BY POCKET KNIFE	150 - 725
R2 (WEAK ROCK)	CAN BE PEELED WITH DIFFICULTY BY POCKET KNIFE	725 - 3,500
R3 (MEDIUM STRONG ROCK)	CAN BE INDENTED 3/16 IN (5 MM) WITH SHARP END OF PICK	3,500 - 7,500
R4 (STRONG ROCK)	REQUIRES ONE BLOW OF GEOLOGIST'S HAMMER TO FRACTURE	7,500 - 15,000
R5 (VERY STRONG ROCK)	REQUIRES MANY BLOWS OF GEOLOGIST'S HAMMER TO FRACTURE	15,000 - 35,000
R6 (EXTREMELY STRONG ROCK)	CAN ONLY BE CHIPPED WITH BLOWS OF GEOLOGIST'S HAMMER	> 35,000

TERMS TO DESCRIBE ROCK WEATHERING AND ALTERATION (ISRM, 1981)

GRADE (TERM)	DESCRIPTION
I (FRESH)	ROCK SHOWS NO DISCOLORATION, LOSS OF STRENGTH, OR OTHER EFFECTS OF WEATHERING/ALTERATION
II (SLIGHTLY WEATHERED/ALTERED)	ROCK IS SLIGHTLY DISCOLORED, BUT NOT NOTICEABLY LOWER IN STRENGTH THAN FRESH ROCK
III (MODERATELY WEATHERED/ALTERED)	ROCK IS DISCOLORED AND NOTICEABLY WEAKENED, BUT LESS THAN HALF IS DECOMPOSED; A MINIMUM 2 IN (50 MM) DIAMETER SAMPLE CANNOT BE BROKEN READILY BY HAND ACROSS THE ROCK FABRIC
IV (HIGHLY WEATHERED/ALTERED)	MORE THAN HALF OF THE ROCK IS DECOMPOSED; ROCK IS WEATHERED SO THAT A MINIMUM 2 IN (50 MM) DIAMETER SAMPLE CAN BE BROKEN READILY BY HAND ACROSS THE ROCK FABRIC
V (COMPLETELY WEATHERED/ALTERED)	ORIGINAL MINERALS OF ROCK HAVE BEEN ALMOST ENTIRELY DECOMPOSED TO SECONDARY MINERALS EVEN THOUGH THE ORIGINAL FABRIC MAY BE INTACT; MATERIAL CAN BE GRANULATED BY HAND
VI (RESIDUAL SOIL)	ORIGINAL MINERALS OF ROCK HAVE BEEN ENTIRELY DECOMPOSED TO SECONDARY MINERALS, AND ORIGINAL ROCK FABRIC IS NOT APPARENT; MATERIAL CAN BE EASILY BROKE BY HAND

TERMS TO DESCRIBE ROCK HARDNESS (FHWA, 2002B)

DESCRIPTION	CHARACTERISTIC
SOFT	RESERVED FOR PLASTIC MATERIAL ALONE.
FRIABLE	EASILY CRUMBLED BY HAND, PULVERIZED OR REDUCED TO POWDER.
LOW HARDNESS	CAN BE GOUGED DEEPLY OR CARVED WITH A POCKET KNIFE.
MODERATELY HARD	CAN BE READILY SCRATCHED BY A KNIFE BLADE; SCRATCH LEAVES A HEAVY TRACE OF DUST AND SCRATCH IS READILY VISIBLE AFTER THE POWDER HAS BEEN BLOW AWAY.
HARD	CAN BE SCRATCHED WITH DIFFICULTY; SCRATCH PRODUCES LITTLE POWDER AND IS OFTEN FAINTLY VISIBLE; TRACES OF THE KNIFE STEEL MAY BE VISIBLE.
VERY HARD	CANNOT BE SCRATCHED WITH POCKET KNIFE. LEAVE KNIFE STEEL MARKS ON SURFACE.

DISCONTINUITY SPACING (AFTER ISRM, 1981)

DESCRIPTION	SPACING (FT)
EXTREMELY WIDE	> 19.7
VERY WIDE	6.6 - 19.7
WIDE	2.0 - 6.6
MODERATE	0.7 - 2.0
CLOSE	0.2 - 0.7
VERY CLOSE	0.07 - 0.2
EXTREMELY CLOSE	< 0.07




ROUGHNESS OF DISCONTINUITY SURFACE (AFTER ISRM, 1981)

TERM	DESCRIPTION
SLICKENSIDED	SURFACE HAS SMOOTH, GLASSY FINISH WITH VISUAL EVIDENCE OF STRIATIONS
SMOOTH	SURFACE APPEARS SMOOTH AND FEELS SO TO THE TOUCH
SLIGHTLY ROUGH	ASPERITIES ON THE DISCONTINUITY SURFACE ARE DISTINGUISHABLE AND CAN BE FELT
ROUGH	SOME RIDGES AND SIDE-ANGLE STEPS ARE EVIDENT; ASPERITIES ARE CLEARLY VISIBLE, AND DISCONTINUITY SURFACE FEELS VERY ABRASIVE
VERY ROUGH	NEAR-VERTICAL STEPS AND RIDGES OCCUR ON THE DISCONTINUITY SURFACE

ROCK QUALITY DESIGNATION (RQD) (FHWA, 1997)

RQD	DESIGNATION
0 - 25	VERY POOR
25 - 50	POOR
50 - 75	FAIR
75 - 90	GOOD
90 - 100	EXCELLENT

ROCK TYPES AND SYMBOLS

	BASALT
	SCORIA
	RHYOLITE TUFF

EXPLORATION LOG KEY ROCK



Project: Theron Ward Judicial Building Expansion, TF21169B
Client: Twin Falls County
Date Excavated: 04-19-2022
Depth to Groundwater: N.E.

Backhoe: Case 580
Bucket Width: 12.0"
Logged By: Z. Lootens



Test Pit:
22-STR-TP1

TEST BOREHOLE - STRATA.GDT - 6/10/22 10:31 - C:\USERS\ZLOOTENS\DROPBOX (STRATA)\TWIN FALLS\SERVER\CLIENTS\TWIN FALLS COUNTY\TF21169B - THERON W WARD REMODEL & EXP/ELECTRONIC LOGS\TEST PIT LOGS.GPJ

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0.0	Fill - Sandy Silt (ML) - Brown, moist, firm to stiff, 8" topsoil.	ML					1.5						Note: BGS = Below Ground Surface
2.5	Loess - Sandy Silt (ML) - Brown, moist, stiff, pinhole structure.	ML				2.0	21.2	65					
4.0	Loess - Silt (ML) - Tan, moist, very stiff to hard, weak to moderately cemented, sparse pinhole structure.	ML		6		4.0							
4.5						4.5							
9.5	Silty Sand (SM) - Tan, dry to moist, very dense, strongly cemented caliche.	SM											

Test Pit Terminated at 9.5 Feet.

Latitude: 42.558772
Longitude: -114.466505

Project: Theron Ward Judicial Building Expansion, TF21169B
Client: Twin Falls County
Date Excavated: 04-19-2022
Depth to Groundwater: N.E.

Backhoe: Case 580
Bucket Width: 12.0"
Logged By: Z. Lootens



Test Pit:
22-STR-TP2

TEST BOREHOLE - STRATA.GDT - 6/10/22 10:31 - C:\USERS\ZLOOTENS\DROPBOX (STRATA)\TWIN FALLS\SERVER\CLIENTS\TWIN FALLS COUNTY\TF21169B - THERON W WARD REMODEL & EXPIELECTRONIC LOGS\TEST PIT LOGS.GPJ

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0.0	Fill - Silt with Sand (ML) - Brown, moist, firm to very stiff, 9" topsoil, with caliche particles.						1.0						Note: BGS = Below Ground Surface
2.5							2.5						
5.0							2.5						
	Loess - Silt (ML) - Tan, moist, firm, pinhole structure.						1.0						
	Loess - Silt with Sand (ML) - Tan, moist, very stiff, sparse pinhole structure, non to weakly cemented.						2.5	27.6		79			
	Loess - Silt (ML) - Tan, moist, hard, moderately to strongly cemented.						4.5						
10.0	Silty Sand (SM) - Tan, dry to moist, very dense, strongly cemented caliche.												

Test Pit Terminated at 10.5 Feet.

Latitude: 42.558938
Longitude: -114.466701

Project: Theron Ward Judicial Building Expansion, TF21169B
Client: Twin Falls County **Backhoe:** Case 580
Date Excavated: 04-19-2022 **Bucket Width:** 12.0"
Depth to Groundwater: N.E. **Logged By:** Z. Lootens



Test Pit:
22-STR-TP3

TEST BOREHOLE - STRATA.GDT - 6/10/22 10:31 - C:\USERS\ZLOOTENS\DROPBOX (STRATA)\TWIN FALLS\SERVER\CLIENTS\TWIN FALLS COUNTY\TF21169B - THERON W WARD REMODEL & EXPIELECTRONIC LOGS\TEST PIT LOGS.GPJ

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0.0	Fill - Sandy Silt (ML) - Brown, moist, firm to stiff, 12" topsoil, with caliche particles.	ML					1.0 2.0						Note: BGS = Below Ground Surface
2.5	Loess - Silty Clay (CL-ML) - Tan, moist, stiff, sparse pinhole structure, non to weakly cemented.	CL-ML											
	Loess - Sandy Silt (ML) - Light brown, moist, very stiff, sparse pinhole structure, moderately cemented.	ML				2.5	27.6	66					
	Loess - Silt with Sand (ML) - Light brown, moist, hard, sparse pinhole structure, moderately cemented.	ML		6		4.5	27.9	89					
5.0		ML											
7.5	Silty Sand (SM) - Tan, dry to moist, very dense, strongly cemented caliche.	SM											

Basalt - black.
 Test Pit Terminated at 8.1 Feet.

Latitude: 42.559035
 Longitude: -114.466173

Project: Theron Ward Judicial Building Expansion, TF21169B
Client: Twin Falls County **Backhoe:** Case 580
Date Excavated: 04-19-2022 **Bucket Width:** 12.0"
Depth to Groundwater: N.E. **Logged By:** Z. Lootens



Test Pit:
22-STR-TP4

TEST BOREHOLE - STRATA.GDT - 6/10/22 10:31 - C:\USERS\ZLOOTENS\DROPBOX (STRATA)\TWIN FALLS\SERVER\CLIENTS\TWIN FALLS COUNTY\TF21169B - THERON W WARD REMODEL & EXPIELECTRONIC LOGS\TEST PIT LOGS.GPJ

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0.0	Fill - Sandy Silt (ML) - Brown, moist, stiff to very stiff, 15" topsoil, with caliche particles.						1.5						Note: BGS = Below Ground Surface
2.5													
5.0													
5.0	Loess - Silty Clay (CL-ML) - Brown, moist, stiff, pinhole structure.						2.0						
5.0	Loess - Silt with Sand (ML) - Tan, moist, stiff, sparse pinhole structure, non to weakly cemented.			6			2.0	23.7	79				
7.5	Loess - Silt (ML) - Tan, moist, hard, moderately to strongly cemented.												
10.0	Silty Sand (SM) - Tan, dry to moist, very dense, strongly cemented caliche.												

Basalt - black.
 Test Pit Terminated at 10.1 Feet.

Latitude: 42.559125
 Longitude: -114.466439

Project: Theron Ward Judicial Building Expansion, TF21169B
Client: Twin Falls County **Backhoe:** Case 580
Date Excavated: 04-19-2022 **Bucket Width:** 12.0"
Depth to Groundwater: N.E. **Logged By:** Z. Lootens



Test Pit:
22-STR-TP5


TEST BOREHOLE - STRATA.GDT - 6/10/22 10:31 - C:\USERS\ZLOOTENS\DROPBOX (STRATA)\TWIN FALLS\SERVER\CLIENTS\TWIN FALLS COUNTY\TF21169B - THERON W WARD REMODEL & EXPIELECTRONIC LOGS\TEST PIT LOGS.GPJ






Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks
0.0	Fill - Sandy Silt (ML) - Brown, moist, firm to stiff, 9" topsoil, tree roots 3', with caliche particles.						0.5						Note: BGS = Below Ground Surface
2.5	Loess - Silty Clay (CL-ML) - Tan, moist, stiff, sparse pinhole structure.					1.5							
	Loess - Silty Sand (SM) - Light brown, moist, medium dense to dense, sparse pinhole structure, moderately to strongly cemented.					4.5		23.2	46				
5.0	Silty Sand (SM) - Tan, dry to moist, very dense, strongly cemented caliche.												
7.5	Basalt - black.												

Test Pit Terminated at 7.6 Feet.

Latitude: 42.559233
Longitude: -114.465898

TEST BOREHOLE - STRATA - 6/10/22 10:31 - C:\USERS\ZLOOTENS\DROPBOX (STRATA)\TWIN FALLS\SERVER\CLIENTS\TWIN FALLS COUNTY\TF21169B - THERON W WARD REMODEL & EXPIELECTRONIC LOGS\TEST PIT LOGS.GPJ

Project: Theron Ward Judicial Building Expansion, TF21169B			Test Pit: 22-STR-TP6
Client: Twin Falls County	Backhoe: Case 580		
Date Excavated: 04-19-2022	Bucket Width: 12.0"		
Depth to Groundwater: N.E.	Logged By: Z. Lootens		

Depth (ft)	USCS Description	Symbol	Sample Type	Recovery (in)	Blows Per 6 Inches	SPT N-Value	Pocket Pen (TSF)	Moisture Content (%)	Dry Density (pcf)	Percent Passing the No. 200 Sieve	Liquid Limit	Plasticity Index	Remarks		
0.0	Fill - Sandy Silt (ML) - Brown, moist, firm to stiff, 9" topsoil, with caliche particles.	 ML					1.0								
2.5							2.5								
5.0							2.0							20.9	67
7.5							2.0								
5.0	Loess - Silt with Sand (ML) - Light brown, moist, stiff to very stiff, sparse pinhole structure, weakly to moderately cemented.	ML													
7.5	Silty Sand (SM) - Tan, moist to wet, very dense, non to weakly cemented caliche.	SM													
	Silty Sand (SM) - Tan, dry to moist, very dense, strongly cemented caliche.	SM													

Test Pit Terminated at 9.0 Feet.

Latitude: 42.559366
Longitude: -114.466114

Appendix B

Laboratory Test Results



Summary of Laboratory Test Results

Project: Theron Ward Judicial Building Expansion
 Client: Twin Falls County

Project Number: TF21169B
 Date: 5/18/2022

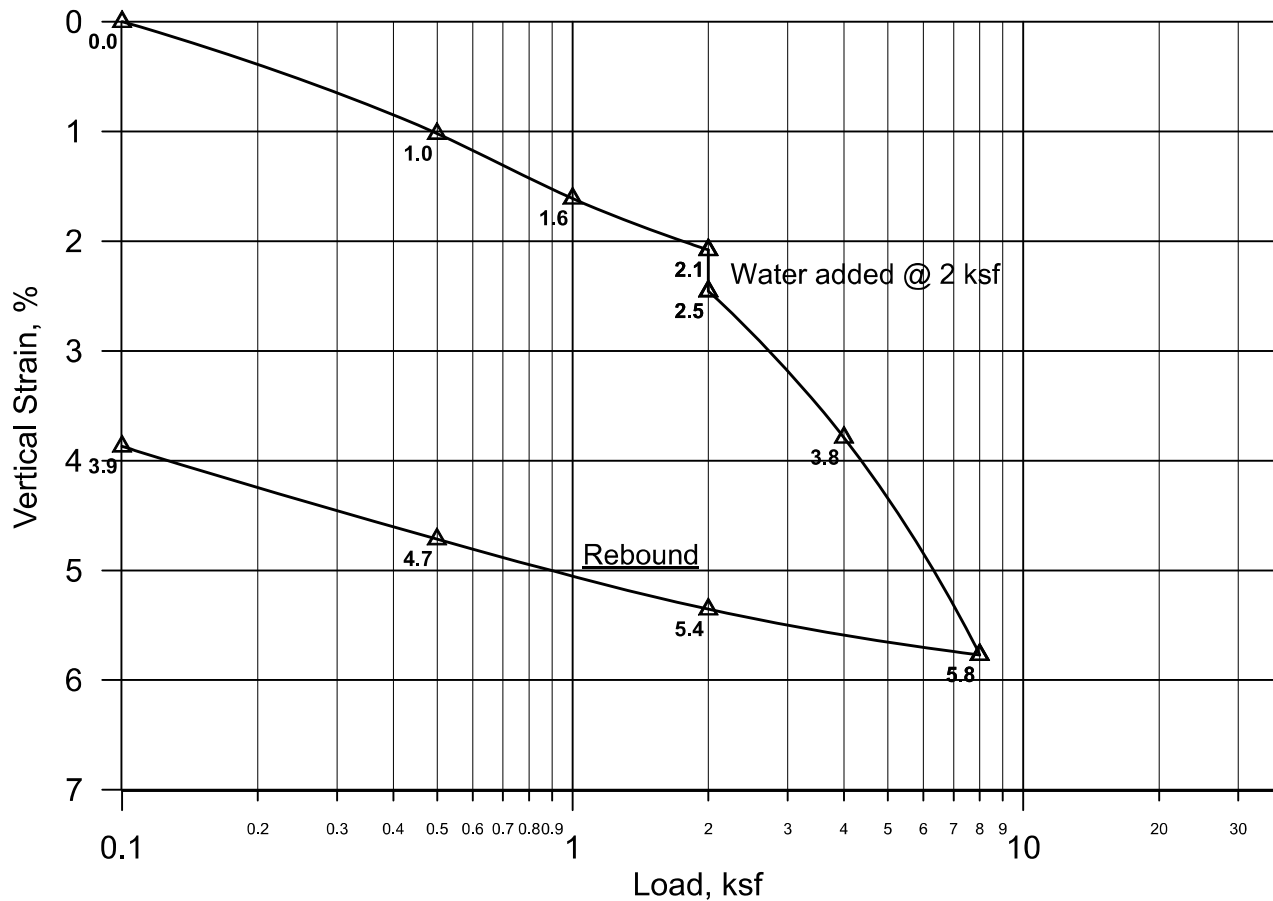
Sample Source	Depth (Feet)	Lab Number	Soil Classification	In Situ Moisture, %	Dry Density, pcf	Passing No. 200, %	Atterberg Limits LL	Atterberg Limits PI	Fines Class.
22-STR-TP1	1.5-2.5	BL220603	Sandy Silt (ML)	21.2	-	65	NT	NT	ML
22-STR-TP2	4.5-5.0		Silt with Sand (ML)	27.6	-	79	-	-	ML
22-STR-TP3	3.5-4.0		Sandy Silt (ML)	27.6	-	66	-	-	ML
22-STR-TP3	4.0-4.5	BL220604	Silt with Sand (ML)	27.9	89.2	-	-	-	ML
22-STR-TP4	4.5-5.0		Silt with Sand (ML)	23.7	-	79	-	-	ML
22-STR-TP4	5.0-5.5	BL220605	Silt with Sand (ML)	23.2	89.2	-	-	-	ML
22-STR-TP5	3.5-4.0		Silty Sand (SM)	23.2	-	46	-	-	ML
22-STR-TP6	3.0-4.0		Sandy Silt (ML)	20.9	-	67	-	-	ML

Reviewed By: By G. Z.

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CONSOLIDATION TEST RESULTS ASTM D D5333

Project: Theron W Ward Remodel & Expansion
Client: Twin Falls County
Project Number: TF21169B
Sample Number: BL220604
Sample Location: 22-STR-TP03 @ 4.0'-4.5'
Sample Classification: Silt with Sand (ML)
Date Tested: 4/26/22 to 5/6/2022
By: K. Wildman
Moisture: 27.9%
Dry Unit Weight: 89.2 pcf

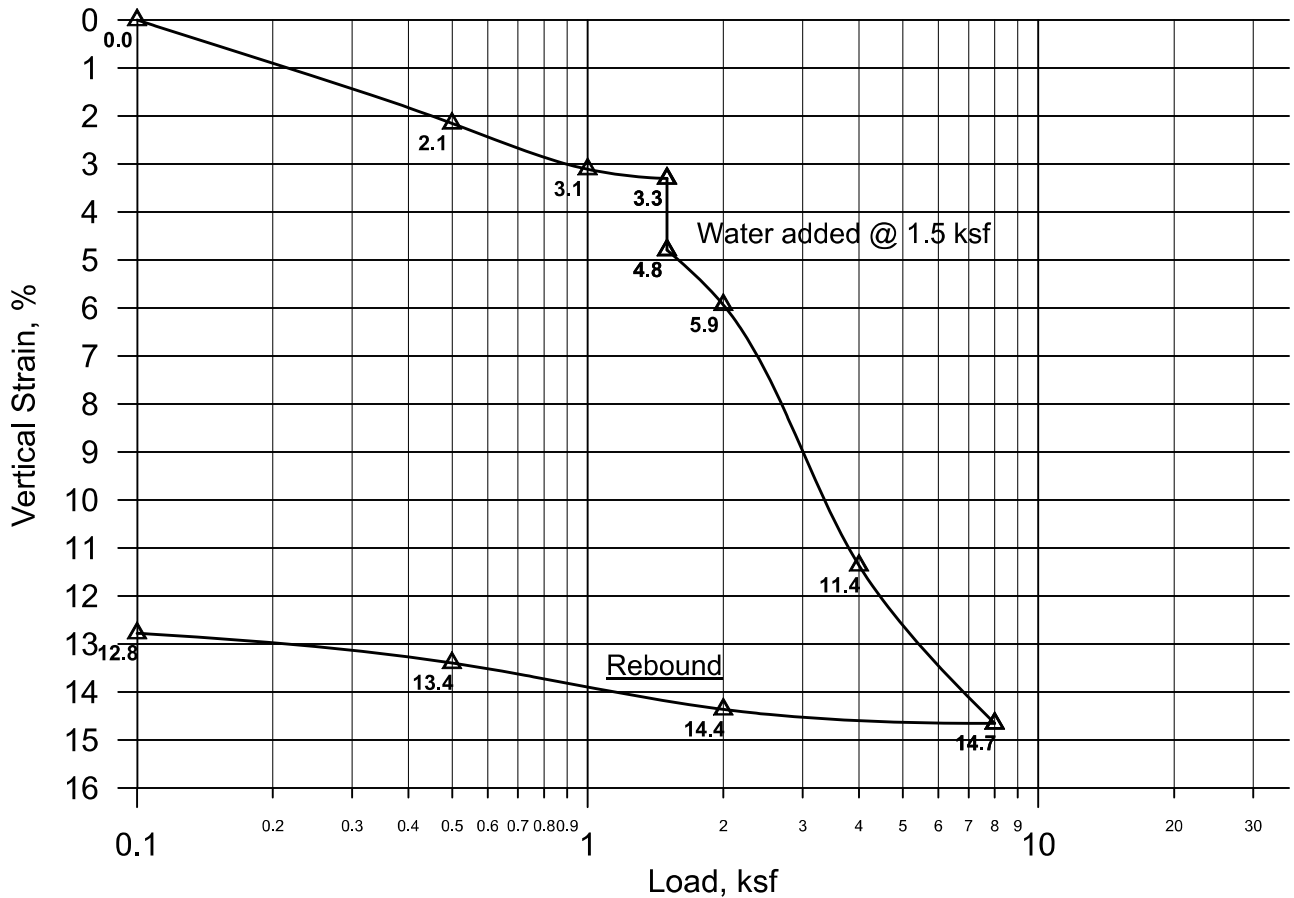


Reviewed By: By C. Z.



CONSOLIDATION TEST RESULTS ASTM D 5333

Project: Theron W Ward Remodel & Expansion
 Client: Twin Falls County
 Project Number: TF21169B
 Sample Number: BL220604
 Sample Location: 22-STR-TP04 @ 5.0'-5.5'
 Sample Classification: Silt with Sand (ML)
 Date Tested: 4/26/22 to 5/6/2022
 By: K. Wildman
 Moisture: 23.2%
 Dry Unit Weight: 89.2 pcf



Reviewed By: Ben C. [Signature]



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February 9, 2023
File: TF21169B

Mr. Bob Beer
Twin Falls County Planning
630 Addison Ave W
Twin Falls, Idaho 83301
Bob.beer@tfco.org
(208) 358-1150

RE: **ADDENDUM**
Geotechnical Engineering Evaluation
Theron W. Ward Judicial Building Remodel
and Expansion with Public Health, Safety
and Technological Upgrades to Prevent or
Control the Spread of Infectious Disease
Twin Falls, Idaho

Dear Bob:

STRATA has prepared this addendum to our Geotechnical Evaluation (Lootens & Gado, 2022) dated August 3, 2022, in response to requests for additional information regarding drainage design for basement walls and elevator shafts. We have provided additional recommendations and a drainage detail schematic. All recommendations from the previously submitted report not discussed within this addendum will remain as originally stated.

Drainage

We understand that the basement walls and elevator shafts will be waterproofed by a system designed by CSHQA. A drainage detail is presented on Plate 2 to supplement our previous recommendations for the basement level wall and to be used in combination with the waterproofing. We recommend providing a drainage system around the perimeter of the basement walls. We understand that the four elevator shafts will have a bottom of footing elevation extend approximately four feet below the basement wall footing and will have a footing thickness of 2 feet. One of the elevator shafts will be located on the perimeter of the wall, while the remaining three shafts will be inset by approximately 8-10 feet from the perimeter. To avoid the additional rock excavation and/or sump installation to install drains at the bottom of the elevator shafts, we recommend installing the perimeter drains for the basement walls only, and designing the elevator shaft walls for potential hydrostatic head acting on the two feet of wall above the footing.

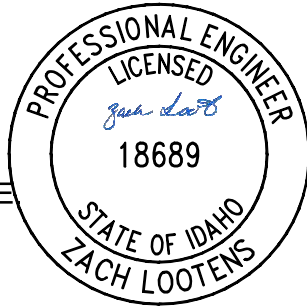
Lateral Earth Pressures

We provided design lateral earth pressures for walls backfilled with Granular Structural Fill in our previous report. After reviewing the proposed floor plan elevations, we expect the elevator shafts will be constructed next to a near vertically cut face in the basalt, which will reduce the lateral earth pressures on the walls. We have compared the previously provided design lateral earth pressures versus earth pressures corrected for rock (Frydman, S. and Keissar, I, 1987) and combined with two feet of hydrostatic pressure to account for installing the wall drains at the basement footing level. The lateral earth pressure diagrams are presented in Appendix C and show that the rock-corrected earth pressures (assuming a 10-ft depth to basalt) with hydrostatic pressures on the elevator shafts walls are lower than the original design pressures given in our report, and re-design/re-evaluation of the wall is not required.

We appreciate the opportunity to continue our relationship with Twin Falls County in support of this project. Please contact us if you have any questions or comments.


Zach Lootens, P.E.
Project Engineer

ZL/DPG/kb



2/9/2023

Sincerely,
STRATA

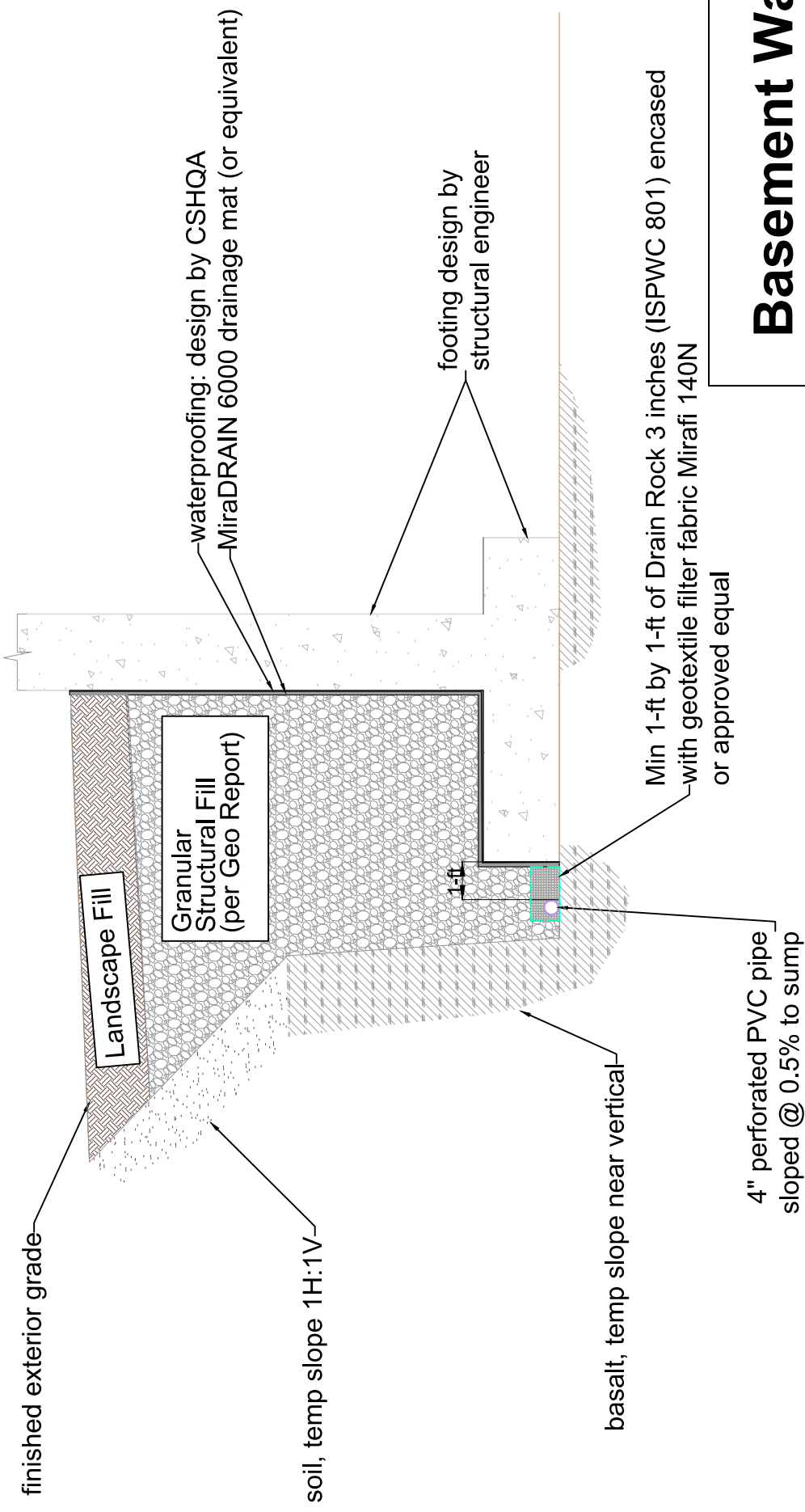

Daniel P. Gado, P.E.
Senior Engineer

Attachments: Plate 2 – Basement Drainage Detail
Appendix C – Lateral Earth Pressure Diagrams

REFERENCES

- Frydman, S. and Keissar, I. "Earth Pressure on Retaining Walls Near Rock Faces". ASCE Journal of Geotechnical Engineering, V113, pp.586-599, 1987.
- Lootens, Z. and Gado, D.P. "Geotechnical Engineering Evaluation Report, Theron W. Judicial Building Remodel and Expansion with Public Health, Safety and Technological Upgrades to Prevent or Control the Spread of Infectious Disease, Twin Falls, Idaho." STRATA, 2022.





Basement Wall Drain Section



Drawing date:	1/30/2023	Project Name	TF Judicial Building
Client	Twin Falls County	Project No.	TF21169
Drawing by:	ZL	Plate:	2
		Checked by:	DPG

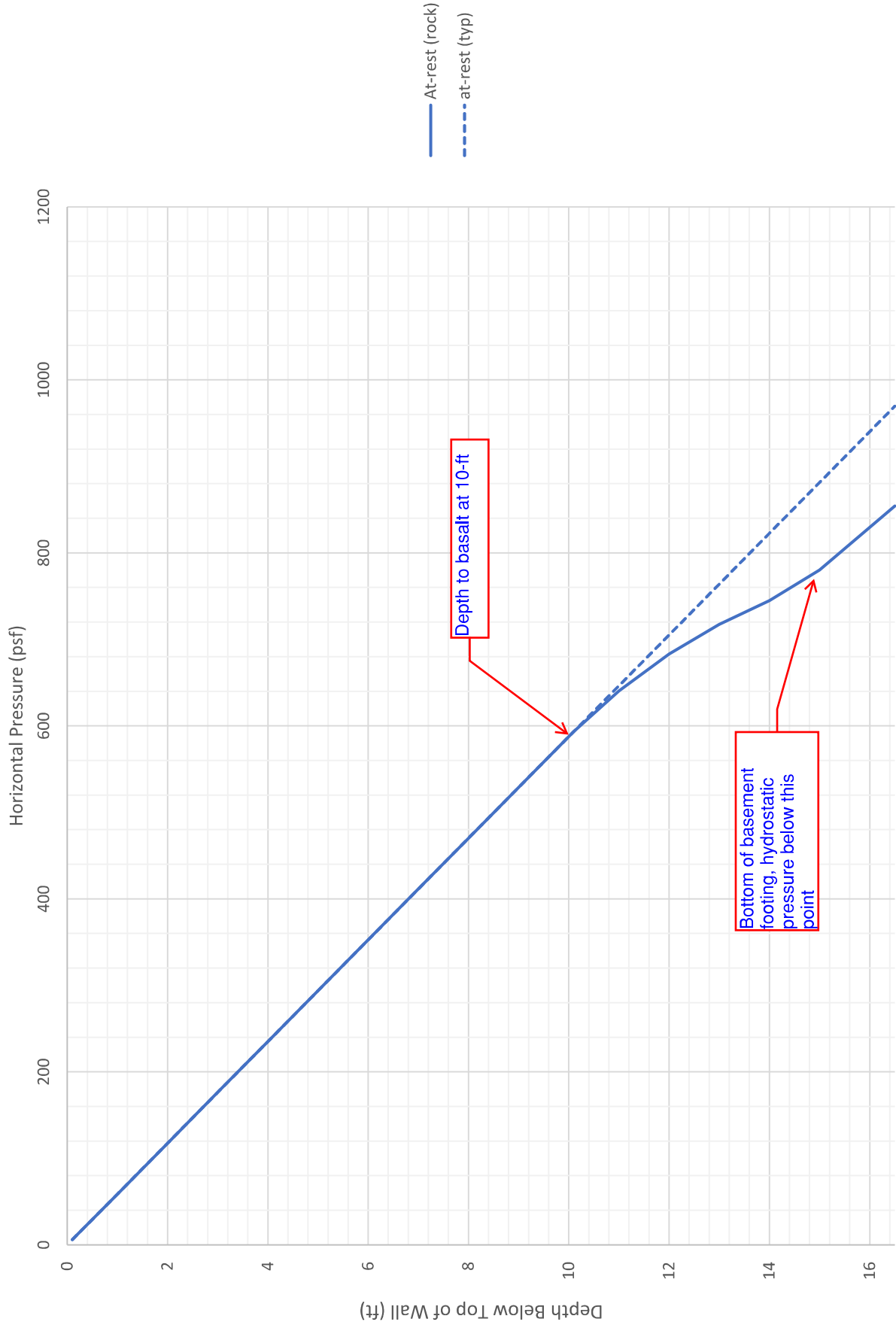
NOT TO SCALE

THIS PLAN COMPRISES A PORTION OF STRATA'S REPORT AND THE TEXT OF THE REPORT CONTAINS ESSENTIAL INFORMATION. BEFORE UTILIZING THIS PLAN FOR ANY PURPOSE WHATSOEVER, THE USER SHOULD BE READ COMPLETELY. THIS PLAN IS INTENDED TO VISUALIZE THE INFORMATION PROVIDED BY STRATA. STRATA MAKES NO WARRANTY, REPRESENTATION, OR GUARANTEE, EXPRESS OR IMPLIED, AS TO THE ACCURACY, COMPLETENESS, OR FITNESS FOR ANY PARTICULAR PURPOSE OF THE INFORMATION PROVIDED BY STRATA. STRATA'S SERVICES WERE NOT PART OF STRATA'S SCOPE OF SERVICES.

Appendix C

Earth Pressure Diagram

Lateral Earth Pressure Basement



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December 16th, 2022
File: TF22169B

Mr. Bob Beer
Twin Falls County Planning
630 Addison Ave W
Twin Falls, Idaho 83301
Bob.beer@tfco.org
(208) 358-1150

RE: **Infiltration Testing Summary**
Theron W. Ward Judicial Building Remodel
and Expansion – Infiltration Testing
427 Shoshone Street N,
Twin Falls, Idaho 83301

Dear Bob:

STRATA is pleased to present this summary of infiltration testing accomplished for the future expansion of the Theron W. Ward Judicial Building in Twin Falls, Idaho. Our services were accomplished on December 9th, 2022 following our subsequent conversations.

Project Background

The Theron W. Ward Judicial Building Remodel is located at 427 Shoshone Street N, Twin Falls, Idaho 83301. The project includes remodeling of the existing courthouse and construction of a 2-story building expansion with a basement.

We understand that stormwater from the proposed development area will be directed to subsurface infiltration facilities on-site. In our previous geotechnical report¹, we recommended subsurface infiltration facilities be located a minimum of 30 feet from the planned basement. STRATA's additional scope of work for this site was to perform infiltration testing at specific locations to measure the in-situ infiltration rate for on-site soils/rock at specified depths. The test locations and depths, provided by Bob Beer with Twin Falls County, are outlined on Plate 1 – Exploration Location Plan.

Subsurface Exploration

STRATA observed the excavation of two test pit explorations (TP-1 and TP-2) on December 9th and performed infiltration testing the same day. A backhoe, provided by Twin Falls County, was used to advance TP-1 to approximately 5-ft, and TP-2 to 6.5-ft. The approximate cross section for test pits TP-1 and TP-2 measured 5-ft by 4-ft and 4-ft by 4-ft, respectively. The general subsurface at the site consists of weak to non-cemented Sandy Silt (ML) overlying strongly cemented silty sand "caliche", underlain by basalt bedrock. Both test pits were extended to the basalt and terminated.

No groundwater was encountered in the test pits at the time our exploration. The depth to groundwater could vary with seasonal precipitation and irrigation.

Subsurface Infiltration

The infiltration testing was performed referencing the Ada County Highway District (ACHD) Stormwater Design "In-Situ Small-Scale Pilot Infiltration Test Method" with slight modifications. The modification to the procedure was to measure infiltration using a falling-head versus a constant head. Test pits were excavated until practical refusal was met on caliche and or basalt. An initial head of 12-inches was set in the test pits and allowed to soak for about an hour before test readings were taken. After saturation, drawdown was measured at approximate 15-minute intervals for a

¹ Lootens, Z., Helms, J. and Gado, D. Geotechnical Engineering Evaluation Report, Theron W. Ward Judicial Building Remodel and Expansion with Public Health, Safety, and Technological Upgrades to Prevent or Control the Spread of Infectious Disease, Twin Falls, Idaho. STRATA, 2022.

duration of two hours. The measured infiltration test depths, rates, and infiltrated soil types are included in the following table. We also provide recommended design infiltration rates with a safety factor of 2.0 to account for lateral seepage.

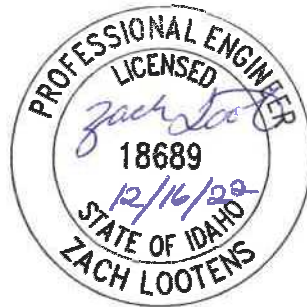
Table 1. Infiltration Test Data

Exploration Location / Depth	Soil/Rock Type	Steady-State Infiltration Rate (in/hr)	Recommended Design Infiltration Rate (in/hr)
TP-1 / 5.0-ft	Basalt	0.5	0.25
TP-2 / 6.5-ft	Basalt	0.5	0.25

If higher infiltration rates are required, drilling 2 to 3-inch diameter holes with a top-hammer/hydraulic rock drill to a depth of approximately 17 feet below grade into the underlying basalt rock on roughly a 5- or 10-foot grid pattern is a viable option to increase the infiltration rate. In this method, the air track holes are backfilled with 3/8-inch fine gravel or coarse sand and covered with at least 12 inches of C-33 filter sand. The drill holes will likely encounter fractured or porous zones in the underlying basalt and may greatly increase the infiltration rate. A small-scale test in the field is recommended if this option is selected. The depth of the holes needs to be less than 18 feet below grade to avoid requiring an injection well permit per Idaho Department of Water Resources.

We strongly recommend subsurface infiltration facilities be located a minimum of 30 feet or more from the planned basement. Lateral seepage from the subsurface infiltration facility could cause hydrostatic pressure on the basement wall and seepage into the basement.

We appreciate the opportunity to work with the project team on the stormwater infiltration phase for the Theron W. Ward Judicial Building Remodel and Expansion. We remain available to assist the design and development team as the project evolves. Please do not hesitate to contact us if you have any questions or comments.



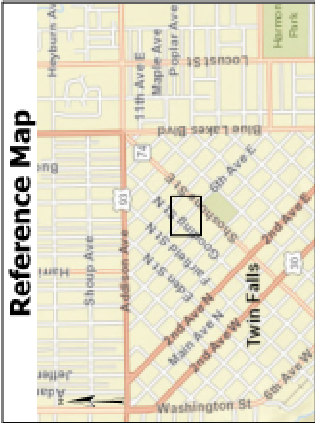
Sincerely,
STRATA

Zach Lootens, P.E.
Project Manager

Daniel P. Gado
Daniel P Gado, P.E.
Senior Geotechnical Engineer

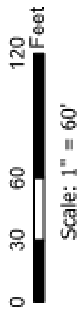
Attachments: Plate 1, Exploration Location Plan





Legend

22-STR-TP1  Approximate location of test pit observed by STRATA on December 9, 2022



EXPLORATION LOCATION PLAN
Theron W. Ward Judicial Building
Remodel and Expansion
Twin Falls, Idaho

Client: Twin Falls County
Client File No.: N/A
Drawn By: G. Jordan
Date: 12/15/2022
File No.: TF211698
Checked By: Z. Loobens
Plate 1

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**SECTION 011000
SUMMARY**

PART 1 GENERAL

1.01 PROJECT

- A. The Project consists of the new construction of a new wing consisting of courtrooms, hearing rooms, and other support spaces for the Theron W. Ward Judicial Building. Additionally,, renovation of existing judicial building space for offices and support space, as well as detention holding areas.

1.02 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.

1.03 WORK BY OWNER

- A. Prior to the installation of the new work, the Owner through Construction Manager will award a contract for asbestos abatement.
- B. Owner will supply the following for installation by applicable Subcontractor:
 - 1. Toilet Accessories as indicated in Section 102800 - Toilet, Bath, and Laundry Accessories .

1.04 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent existing buildings through Phase 1.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.05 USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Existing building spaces may not be used for storage.
 - 1. Materials may be stored in shell during Phase 2 in compliance with safety requirements. .
- D. Time Restrictions:
 - 1. Limit conduct of especially noisy exterior work to the hours of after 5 pm and before 8 am on weekdays.
- E. Utility Outages and Shutdown:
 - 1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - 2. Limit shutdown of utility services to 3 hours at a time, arranged at least 24 hours in advance with Owner.
 - 3. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 011000

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**SECTION 012300
ALTERNATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Description of Alternates.
- B. Procedures for pricing Alternates.

1.02 ACCEPTANCE OF ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Construction Manager's option,
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

- A. Alternate No. 1 - UV Light at Roof Top Units:
 - 1. Base Bid: Do not provide UV light at Roof Top Units as indicated on Drawings and in Specifications.
 - 2. Alternate Item: Provide UV light at Roof Top Units as indicated on Drawings and in Specifications.
- B. Alternate No. 2 - Insulation:
 - 1. Base Bid: Provide batt insulation at exterior wall assemblies as indicated on Drawings and as specified in Section 072100 - Thermal Insulation
 - 2. Alternate Item: Provide spray foam insulation at exterior wall assemblies as indicated on Drawings and as specified in Section 072119 - Foamed-In-Place Insulation.
- C. Alternate No. 3 - Perforated Pipe
 - 1. Base Bid: Coordinate small scale infiltration testing with Strata after excavation to appropriate depth for basement footings to determine if alternate foundation drain measures are required.
 - 2. Alternate Item: Add perforated pipe wrapped in drain rock and filter fabric designed to convey water to pump station with discharge to on-site storm drain piping.
- D. Alternate No. 4 - Not Used.
- E. Alternate No. 5 - Detention Doors
 - 1. Base Bid: Include 12 gauge detention hollow metal doors and frames as specified in Section 111913 - Detention Hollow Metal Doors and Frames with Airteq 604 FMCS hinges as specified in 111953 - Detention Hardware, and as shown on Sheet A75.4
 - 2. Alternate Item: Install 14 gauge, maximum duty, hollow metal doors and frames as shown on Sheet A75.4 as specified in Section 081113 - Hollow Metal Doors and Frames, with Stanley 5 Knuckle Full Mortise Hinges, as specified in 087100 - Door Hardware and as shown on Sheet A75.4.
 - 3. Note: Glazing for Detention Doors in Base Bid and in Alternate is specified in Section 111908 - Security Glazing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 012300

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**SECTION 012500
SUBSTITUTION PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Subcontractor to materials, products, assemblies, and equipment.
1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Subcontractor's control.
 2. Substitutions for Convenience: Not allowed.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 2. Agrees to provide the same warranty for the substitution as for the specified product.
 3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 4. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
1. Use form approved by Architect and Construction Manager. Include the following:
 - a. Project Information:
 - 1) Official project name and number, and any additional required identifiers established in Contract Documents.
 - b. Substitution Request Information:
 - 1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
 - 2) Issue date.
 - 3) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
 - 4) Description of Substitution.
 - 5) Reason why the specified item cannot be provided.
 - 6) Differences between proposed substitution and specified item.
 - 7) Description of how proposed substitution affects other parts of work.
 - c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:
 - 1) Physical characteristics.
 - 2) In-service performance.
 - 3) Expected durability.
 - 4) Visual effect.
 - 5) Sustainable design features.
 - 6) Warranties.
 - 7) Other salient features and requirements.

- 8) Include, as appropriate or requested, the following types of documentation:
 - (a) Product Data:
 - (b) Samples.
 - (c) Certificates, test, reports or similar qualification data.
 - (d) Drawings, when required to show impact on adjacent construction elements.
- d. Impact of Substitution:
 - 1) Savings to Owner for accepting substitution.
 - 2) Change to Contract Time due to accepting substitution.
- D. Limit each request to a single proposed substitution item.
 1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Architect will consider requests for substitutions only within 15 calendar days after date of Agreement.
- B. Submit request for Substitution for Cause immediately upon discovery of need for substitution, but not later than 14 calendar days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- C. Substitutions will not be considered under one or more of the following circumstances:
 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 2. Without a separate written request.
 3. When acceptance will require revisions to Contract Documents.

3.03 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Construction Manager in writing of decision to accept or reject request.

3.04 ACCEPTANCE

- A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION 012500

**SECTION 013000
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Electronic document submittal service.
- C. Preconstruction meeting.
- D. Progress meetings.
- E. Construction progress schedule.
- F. Coordination drawings.
- G. Submittals for review, information, and project closeout.
- H. Requests for Interpretation (RFI) procedures.
- I. Submittal procedures.

1.02 RELATED REQUIREMENTS

- A. Section 016000 - Product Requirements: General product requirements.
- B. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
 - 1. Requests for Information (RFI).
 - 2. Requests for substitution.
 - 3. Shop drawings, product data, and samples.
 - 4. Test and inspection reports.
 - 5. Design data.
 - 6. Manufacturer's instructions and field reports.
 - 7. Applications for payment and change order requests.
 - 8. Progress schedules.
 - 9. Coordination drawings.
 - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
 - 11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted electronically.
 - 1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Construction Manager's correction punchlist, and any other document any participant wishes to make part of the project record.
 - 2. Paper document transmittals will not be reviewed.

3.02 PRECONSTRUCTION MEETING

- A. Construction Manager will schedule a meeting prior to work commencing.
- B. Attendance Required:
 - 1. Construction Manager.
 - 2. Architect.
 - 3. Major Subcontractors.
 - 4. Owner's Representative.
- C. Some participants may attend meeting via internet virtual meeting platform.
- D. Agenda:
 - 1. Submission of executed bonds and insurance certificates.
 - 2. Distribution of Contract Documents.
 - 3. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
 - 4. Designation of personnel representing the parties to Contract, other parties as needed, and Architect.
 - 5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
 - 6. Scheduling.
- E. Construction Manager will record minutes and distribute electronic copies within two days after meeting to participants, including Architect, Owner's Representative, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the work at periodic intervals.
 - 1. Provide for participants to attend remotely via videoconferencing.
 - 2. Conference room used to host meeting must have adequate voice, camera, and computing capabilities to provide clear videoconferencing ability. Verify prior to first scheduled meeting.
- B. Attendance Required:
 - 1. Construction Manager.
 - 2. Architect.
 - 3. Construction Manager's superintendent.
 - 4. Major subcontractors.
 - 5. Owner's Representative.
 - 6. Attendees may participate remotely via videoconferencing.
- C. Agenda:
 - 1. Review Construction Manager's minutes of previous meetings.
 - 2. Review of work progress.
 - 3. BIM Coordination including resolution of BIM component conflicts. .
 - 4. Field observations, problems, and decisions.
 - 5. Identification of problems that impede, or will impede, planned progress.
 - 6. Review of submittals schedule and status of submittals.
 - 7. Review of RFIs log and status of responses.
 - 8. Review of off-site fabrication and delivery schedules.
 - 9. Maintenance of progress schedule.
 - 10. Corrective measures to regain projected schedules.
 - 11. Planned progress during succeeding work period.
 - 12. Coordination of projected progress.
 - 13. Maintenance of quality and work standards.
 - 14. Effect of proposed changes on progress schedule and coordination.
 - 15. Other business relating to work.

- D. Record minutes and distribute electronic copies within two business days after meeting to participants, in Architect, Owner's Representative, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE

- A. Within 10 days after date established in Notice to Proceed, Construction Manager shall provide a preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 business days.
- C. Within 20 business days after review of preliminary schedule, submit draft of proposed complete schedule for review.
- D. Within 10 business days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

3.05 COORDINATION DRAWINGS

- A. Provide information required for preparation of coordination drawings and BIM coordination.
 - 1. Construction Manager shall execute a data licensing agreement in the form of Agreement Between Architect and Construction Manager to be provided.
 - 2. Subcontractors, and other parties granted access by Construction Manager to Architect's digital data files shall execute the same data licensing agreement.
 - 3. Upon execution of the agreement, Architect will furnish Construction Manager digital data files of the Drawings for use in preparing coordination digital data files.
 - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to the Drawings.
- B. Review drawings prior to submission to Architect.

3.06 REQUESTS FOR INFORMATION (RFI)

- A. Definition: A request seeking one of the following:
 - 1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
 - 2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
 - 1. Prepare a separate RFI for each specific item.
 - a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
 - b. Do not forward requests which solely require internal coordination between subcontractors.
 - 2. Transmit electronically using form approved by Construction Manager.
 - 3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
- D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
 - 1. Include in each request Subcontractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
 - 2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:

- a. Approval of submittals (use procedures specified elsewhere in this section).
- b. Approval of substitutions (see Section - 016000 - Product Requirements)
- c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
- d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.
 - a. The Construction Manager reserves the right to assess the Subcontractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.
- E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
 1. Official Project name and number, and any additional required identifiers established in Contract Documents.
 2. Owner's Representative's, Architect's, and Construction Manager's names.
 3. Discrete and consecutive RFI number, and descriptive subject/title.
 4. Issue date, and requested reply date.
 5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
 6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
 7. Construction Manager's and/or Subcontractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
 2. Note dates of when each request is made, and when a response is received.
 3. Highlight items requiring priority or expedited response.
 4. Highlight items for which a timely response has not been received to date.
- H. Review Time: Architect will respond and return RFIs to Construction Manager within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 3:00 PM Mountain Time will be considered as having been received on the following regular business day. RFIs received after 12:00 PM (noon) Mountain Time on Friday, will be considered as having been received on the following business day.
 1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.
- I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Construction Manager's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner's Representative via Construction Manager.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.07 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
 1. Product data.
 2. Shop drawings.
 3. Samples for selection.
 4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide electronic copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

3.08 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
 1. Design data.
 2. Sustainability design submittals and reports.
 3. Certificates.
 4. Test reports.
 5. Inspection reports.
 6. Manufacturer's instructions.
 7. Manufacturer's field reports.
 8. Other types indicated.

3.09 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
 1. Project record documents.
 2. Operation and maintenance data.
 3. Warranties.
 4. Bonds.
 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

3.10 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
 1. After review, produce duplicates.

2. Retained samples will not be returned to Construction Manager unless specifically so stated.

3.11 SUBMITTAL PROCEDURES

A. General Requirements:

1. Use a separate transmittal for each item.
2. Transmit electronically using form approved by Construction Manager and Architect.
3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
4. Identify: Project; Construction Manager; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
5. Construction Manager will apply stamp, signature or initials certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
 - a. Submittals from sources other than the Construction Manager, or without Construction Manager's stamp will not be acknowledged, reviewed, or returned.
6. Schedule submittals to expedite the Project, and coordinate submission of related items.
 - a. For each submittal for review, allow 15 calendar days excluding delivery time to and from the Construction Manager.
 - b. For sequential reviews involving Architect's consultants, Construction Manager, or another affected party, allow an additional 7 calendar days after receipt.
 - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 calendar days.
7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
8. Provide space for Construction Manager and Architect review stamps.
9. When revised for resubmission, identify all changes made since previous submission.
10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
12. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:

1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.
5. Submit sustainable design reporting submittals under separate cover.
6. Where a Basis of Design product is indicated in the Specifications but products or assemblies by other manufacturers listed as acceptable are submitted, provide a table with a side-by-side comparison of the submitted product or assembly and the Basis of Design. Include physical properties, colors as applicable, warranty, and performance data as specified.
 - a. Products and assemblies submitted other than the Basis of Design, must be equal or better.
 - b. If the Architect determines that the product or assembly is not equal or better products or assemblies shall be resubmitted and align with this paragraph.

C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.

3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
 1. Transmit related items together as single package.
 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.12 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
- D. Architect's and consultants' actions on items submitted for review:
 1. Authorizing purchasing, fabrication, delivery, and installation:
 - a. "Furnish as Submitted", or language with same legal meaning.
 - b. "Furnish as Noted", or language with same legal meaning.
 - 1) At Construction Manager's or Subcontractor's option, submit corrected item, with review notations acknowledged and incorporated.
 - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
 2. Not Authorizing fabrication, delivery, and installation:
 - a. "Return for Corrections".
 - 1) Resubmit revised item, with review notations acknowledged and incorporated.
 - b. "Rejected - See Remarks".
 - 1) Submit item complying with requirements of Contract Documents.

END OF SECTION 013000

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**SECTION 014000
QUALITY REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. References and standards.
- C. Testing and inspection agencies and services.
- D. Control of installation.
- E. Mock-ups.
- F. Tolerances.
- G. Manufacturers' field services.
- H. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Document 003100 - Available Project Information: Soil investigation data.
- B. Section 011000 - Summary: Description of Work.
- C. Section 016000 - Product Requirements: Requirements for material and product quality.

1.03 SUBMITTALS

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

1.04 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Owner will employ services of an independent testing agency to perform certain specified testing; payment for cost of services will be provide by Owner.
- B. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

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

3.02 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, for construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- D. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- E. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

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 TESTING AND INSPECTION

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
 - 1. Provide qualified personnel at site. Cooperate with Architect and Construction Manager in performance of services.
 - 2. Perform specified sampling and testing of products in accordance with specified standards.
 - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 - 4. Promptly notify Architect and Construction Manager of observed irregularities or non-compliance of Work or products.
 - 5. Perform additional tests and inspections required by Architect.
 - 6. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the Work.
 3. Agency may not assume any duties of Construction Manager.
 4. Agency has no authority to stop the Work.
- D. Construction Manager will:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
 5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Construction Manager beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-compliance with specified requirements shall be paid for by Subcontractor responsible for non-compliant work.

3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

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

END OF SECTION 014000

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**SECTION 014533
CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Code-required special inspections.
- B. Testing services incidental to special inspections.
- C. Submittals.
- D. Manufacturers' field services.
- E. Fabricators' field services.

1.02 ABBREVIATIONS AND ACRONYMS

- A. NIST: National Institute of Standards and Technology.

1.03 REFERENCE STANDARDS

- A. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- B. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.
- C. IAS AC291 - Accreditation Criteria for Special Inspection Agencies AC291 2019.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Special Inspection Agency Qualifications: Prior to the start of work, the Special Inspection Agency is required to:
 - 1. Submit agency name, address, and telephone number, names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Special Inspection Agency is acceptable to AHJ where applicable..
- C. Testing Agency Qualifications: Prior to the start of work, the Testing Agency is required to:
 - 1. Submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
 - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
 - 3. Submit certification that Testing Agency is acceptable to AHJ.

1.05 SPECIAL INSPECTION AGENCY

- A. Owner through Construction Manager will employ services of a Special Inspection Agency to perform inspections and associated testing and sampling in accordance with ASTM E329 and required by the building code.
- B. The Special Inspection Agency may employ and pay for services of an independent testing agency to perform testing and sampling associated with special inspections and required by the building code.

1.06 TESTING AND INSPECTION AGENCIES

- A. Owner may elect to employ services of an independent testing agency to perform additional testing and sampling associated with special inspections but not required by the building code.
- B. Employment of agency in no way relieves responsible Subcontractors of obligation to perform work in accordance with requirements of Contract Documents.

1.07 QUALITY ASSURANCE

- A. Special Inspection Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
 - 2. Accredited by IAS according to IAS AC291.
- B. Testing Agency Qualifications:
 - 1. Independent firm specializing in performing testing and inspections of the type specified in this section.
- C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SPECIAL INSPECTIONS, GENERAL

- A. Frequency of Special Inspections: Special Inspections are indicated as continuous or periodic.
 - 1. Continuous Special Inspection: Special Inspection Agency is required to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspection: Special Inspection Agency is required to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

3.02 SPECIAL INSPECTION AGENCY DUTIES AND RESPONSIBILITIES

- A. Special Inspection Agency shall:
 - 1. Verify samples submitted by Construction Manager or Subcontractors comply with the referenced standards and the approved Contract Documents.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Construction Manager in performance of services.
 - 3. Perform specified sampling and testing of products in accordance with specified reference standards.
 - 4. Ascertain compliance of materials and products with requirements of Contract Documents.
 - 5. Promptly notify Architect and Construction Manager of observed irregularities or non-compliance of work or products.
 - 6. Perform additional tests and inspections required by Architect.
 - 7. Submit reports of all tests or inspections specified.
- B. Limits on Special Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the work.
 - 3. Agency may not assume any duties of Construction Manager.
 - 4. Agency has no authority to stop the work.
- C. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- D. Re-testing required because of non-compliance with specified requirements shall be paid for by Subcontractor responsible for non-compliant work.

3.03 TESTING AGENCY DUTIES AND RESPONSIBILITIES

- A. Testing Agency Duties:
 - 1. Test samples submitted by Construction Manager.
 - 2. Provide qualified personnel at site. Cooperate with Architect and Construction Manager in performance of services.

3. Perform specified sampling and testing of products in accordance with specified standards.
 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
 5. Promptly notify Architect and Construction Manager of observed irregularities or non-compliance of work or products.
 6. Perform additional tests and inspections required by Architect.
 7. Submit reports of all tests or inspections specified.
- B. Limits on Testing or Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Agency may not approve or accept any portion of the work.
 3. Agency may not assume any duties of Construction Manager.
 4. Agency has no authority to stop the work.
- C. On instructions by Architect, perform re-testing required because of non-compliance with specified requirements, using the same agency.
- D. Subcontractor responsible for not-complaint work will pay for re-testing required because of non-compliance with specified requirements.

3.04 GENERAL DUTIES AND RESPONSIBILITIES

- A. Construction Manager, General:
1. Deliver to agency at designated location, adequate samples of materials for special inspections that require material verification.
 2. Cooperate with agency and laboratory personnel; provide access to approved documents at project site, to the work, to manufacturers' facilities, and to fabricators' facilities.
 3. Provide incidental labor and facilities:
 - a. To provide access to work to be tested or inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested or inspected.
 - c. To facilitate tests or inspections.
 - d. To provide storage and curing of test samples.
 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing or inspection services.
 5. Arrange with Owner's agency through Construction Manager and pay for additional samples, tests, and inspections required by Construction Manager beyond specified requirements.

3.05 MANUFACTURERS' AND FABRICATORS' FIELD SERVICES

- A. When specified in individual specification sections, require material suppliers, assembly fabricators, or product manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, to test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

END OF SECTION 014533

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**SECTION 015000
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Waste removal facilities and services.
- F. Project signage.
- G. Field offices.

1.02 GENERAL

- A. Arrangement for and payment for Temporary Facilities and Controls are covered in a separate agreement between Owner and Construction Manager.

1.03 TEMPORARY UTILITIES

- A. Construction Manager to pay cost of connecting and maintaining connections for the following utilities:
 - 1. Electrical power and metering, consisting of connection to existing facilities.
 - 2. Water supply, consisting of connection to existing facilities.
 - 3. Sewer-service use, consisting of connection to existing facilities.
- B. Owner will pay utilities costs.
- C. The Construction Manager will responsible for connections and extensions of services as required for construction operations.
 - 1. Services include electrical power, water supply, and sewer-service.
 - 2. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 - 3. Connections and extensions shall be made in compliance with local codes and laws.

1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.05 LIGHTING

- A. Provide temporary lighting to meet the following:
 - 1. Local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 2. Meets security and protection requirements without operating entire system.
 - 3. Illuminates project identification sign adequately.

1.06 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
 - 1. Provide temporary utilities to remove effluent lawfully.
 - 2. 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.
- B. Maintain daily in clean and sanitary condition.

1.07 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.08 FENCING

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.09 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. 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.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT SIGNAGE

- A. Provide project identification sign of design, construction, and location approved by Owner.
- B. Temporary Signs: Provide temporary, directional signs for construction personnel and visitors.
- C. No other signs are allowed without Owner permission except those required by law.

1.12 FIELD OFFICES

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition.
- E. Restore new permanent facilities used during construction to specified condition.

CSHQA, Inc.
Agency Review Set
April 21, 2023

Theron W. Ward Judicial Building Remodel and Expansion
Twin Falls, Idaho
Project No.: 21403.000

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 015000

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**SECTION 016000
PRODUCT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 014000 - Quality Requirements: Product quality monitoring.

1.03 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. See Section 014000 - Quality Requirements, for additional source quality control requirements.
- C. Use of products having any of the following characteristics is not permitted:

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.03 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

3.01 SUBSTITUTION LIMITATIONS

- A. See Section 012500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- F. For exterior storage of fabricated products, place on sloped supports above ground.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- J. Prevent contact with material that may cause corrosion, discoloration, or staining.
- K. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- L. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 016000

**SECTION 017000
EXECUTION AND CLOSEOUT REQUIREMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Cutting and patching.
- C. Cleaning and protection.
- D. Starting of systems and equipment.
- E. Demonstration and instruction of Owner personnel.
- F. Closeout procedures, including Construction Manager's Correction Punch List, except payment procedures.
- G. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy.
- B. Section 013000 - Administrative Requirements: Submittals procedures.
- C. Section 014000 - Quality Requirements: Testing and inspection procedures.
- D. Section 017800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- E. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- F. Individual Product Specification Sections:
 - 1. Advance notification to other sections of openings required in work of those sections.

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.

1.05 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- C. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. All work conducted in or adjacent to active court facility: Any work that produces disruptive levels of noise must be conducted before 8:00 am or after 5:00 pm. Coordinate and schedule the performance of this work with the Construction Manager

- E. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

1.06 COORDINATION

- A. Notify affected utility companies and comply with their requirements.
- B. 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.
- C. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- D. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of work of separate sections.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
- H. Maintain a complete and accurate log of control and survey work as it progresses.

3.04 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.05 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.
- I. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.06 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.08 SYSTEM STARTUP

- A. Coordinate with requirements of Section 019113 - General Commissioning Requirements.
- B. Coordinate schedule for start-up of various equipment and systems.
- C. 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.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Construction Manager and/or Subcontractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. 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.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.09 DEMONSTRATION AND INSTRUCTION

- A. See Section 017900 - Demonstration and Training.

3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.11 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, downspouts, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.12 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
- B. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- C. Submit written certification containing Construction Manager's Correction Punch List, 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 Substantial Completion inspection.
- D. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Construction Manager's comprehensive list of items identified to be completed or corrected and submit to Architect.
- E. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- F. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- G. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.13 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION 017000

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**SECTION 017800
CLOSEOUT SUBMITTALS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 2. Submit one copy of completed documents 15 business days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
 - 3. Submit electronic sets of revised final documents in final form within 10 business days after final inspection.
- B. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction, submit documents within 10 business days after acceptance.
 - 2. Make other submittals within 10 business 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 business days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.

3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 1. Field changes of dimension and detail.
 2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 1. Description of unit or system, and component parts.
 2. Identify function, normal operating characteristics, and limiting conditions.
 3. Include performance curves, with engineering data and tests.
 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's PDF file of operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Provide control diagrams by controls manufacturer as installed.
- J. Provide Subcontractor's coordination drawings, with color coded piping diagrams as installed.
- K. Additional Requirements: As specified in individual product specification sections.

3.04 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data in the form of a multiple file composite electronic PDF file for each manual type required for Owner's use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide bookmark for each system.
- C. 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.
 1. If file size requires, compile operation manuals in multiple file volumes.
- D. File Names and Bookmarks:
 1. Bookmark individual documents based on file names.

2. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents.
 3. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual.
 4. Use bookmarks that reflect system, subsystem, and equipment names in readily navigable file tree.
 5. Configure electronic manual to display bookmark panel on opening file.
- E. Include the following information:
1. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Construction Manager and subcontractors, with names of responsible parties.
 2. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

3.05 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 business days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Subcontractor responsible for warranted work, and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION 017800

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**SECTION 017900
DEMONSTRATION AND TRAINING**

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Conveying systems.
 - 6. Landscape irrigation.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Fixtures and fittings.
 - 4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Provide an overall schedule showing all training sessions.
 - 2. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Construction Manager/Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
 - 4. Provide electronic file of Training Manuals.
- D. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
 - 1. Format: As selected by Owner.
 - 2. Label each with session identification and date.

1.04 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.

1. Provide as instructors the most qualified trainer of those contractors/subcontractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Provide training in minimum two hour segments.
- C. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner.
- D. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 3. Typical uses of the O&M manuals.
- E. Product- and System-Specific Training:
 1. Review the applicable O&M manuals.
 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 6. Discuss common troubleshooting problems and solutions.
 7. Discuss any peculiarities of equipment installation or operation.
 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 10. Review spare parts and tools required to be furnished by Construction Manager and/or Subcontractors.
 11. Review spare parts suppliers and sources and procurement procedures.

- F. Be prepared to answer questions raised by training attendees.

END OF SECTION 017900

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**SECTION 019113
GENERAL COMMISSIONING REQUIREMENTS**

PART 1 GENERAL

1.01 SUMMARY

- A. Commissioning is intended to achieve the following specific objectives; this section specifies the Construction Manager's responsibilities for commissioning:
 - 1. Verify that the work is installed in accordance with Contract Documents and the manufacturer's recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Construction Manager are utilized to achieve this.
 - 2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Construction Manager and witnessed by the Commissioning Authority are utilized to achieve this.
 - 3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Construction Manager are utilized to achieve this.
 - 4. Verify that the Owner's operating personnel are adequately trained: Formal training conducted by Construction Manager is utilized to achieve this.
- B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

1.02 RELATED REQUIREMENTS

- A. Section 017800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
 - 1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.
 - 2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.
 - 3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.
- C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.
- D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.
 - 1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Owner.

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

- A. Commissioning Authority has prepared the Commissioning Plan.

1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
 2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.
- B. Construction Manager is responsible for compliance with the Commissioning Plan.
- C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.
- D. Commissioning Schedule:
1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
 2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.
 3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
 4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

- A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.
- B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.
- C. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

- A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.
1. No sampling of identical or near-identical items is allowed.
 2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
 3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
 - a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
 - b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
 - c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
 - d. Serial number of installed unit.
 - e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.
 - f. Sensor and actuator calibration information.
- B. Construction Manager is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.
1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Construction Manager attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
 3. Individual Checklists may contain line items that are the responsibility of more than one installer; Construction Manager shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
 4. If any Checklist line item is not relevant, record reasons on the form.
 5. Construction Manager may independently perform startup inspections and/or tests, at Construction Manager's option.
 6. Regardless of these reporting requirements, Construction Manager is responsible for correct startup and operation.
 7. Submit completed Checklists to Commissioning Authority within two days of completion.
- C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Construction Manager.
1. Initial Drafts: Construction Manager is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
 2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
 3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
 4. When asked to review the proposed Checklists, do so in a timely manner.
- D. Commissioning Authority Witnessing: Required for:
1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.
 2. A sampling of non-primary equipment, as allowed by the commissioning plan.
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

- A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.
- B. Construction Manager is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.
- C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.
- D. Construction Manager is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Construction Manager's stated intentions regarding correction.
 1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
 2. When the deficiency has been corrected, the Construction Manager completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Construction Manager shall re-test.

3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
 4. Construction Manager shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
 5. Construction Manager shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Construction Manager shall bear the cost of the second and subsequent re-tests.
- E. Functional Test Procedures:
1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Construction Manager.
 2. Examples of Functional Testing:
 - a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
 - b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
 - c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.
 - d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.
- F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Construction Manager's responsibility regardless of timing.

3.05 SENSOR AND ACTUATOR CALIBRATION

- A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.
- B. Calibrate using the methods described below; alternate methods may be used, if approved by Commissioning Authority, Owner, and Construction Manager beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.
- C. All Sensors:
 1. Verify that sensor location is appropriate and away from potential causes of erratic operation.
 2. Verify that sensors with shielded cable are grounded only at one end.
 3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.
 4. Tolerances for critical applications may be tighter.
- D. Sensors Without Transmitters - Standard Application:
 1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.

2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
 3. If not, install offset, calibrate or replace sensor.
- E. Sensors With Transmitters - Standard Application.
1. Disconnect sensor.
 2. Connect a signal generator in place of sensor.
 3. Connect ammeter in series between transmitter and building automation system control panel.
 4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
 5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
 6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
 7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
 8. Reconnect sensor.
 9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
 10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
 11. If not, replace sensor and repeat.
 12. For pressure sensors, perform a similar process with a suitable signal generator.
- F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:
1. Watthour, Voltage, Amperage: 1 percent of design.
 2. Pressure, Air, Water, Gas: 3 percent of design.
 3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
 4. Relative Humidity: 4 percent of design.
 5. Barometric Pressure: 0.1 inch of Hg.
 6. Flow Rate, Air: 10 percent of design.
 7. Flow Rate, Water: 4 percent of design.
 8. AHU Wet Bulb and Dew Point: 2.0 degrees F.
- G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.
- H. Valve/Damper Stroke Setup and Check:
1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 2. Set pump/fan to normal operating mode.
 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 4. Command valve/damper to open; verify position is full open and adjust output signal as required.
 5. Command valve/damper to a few intermediate positions.
 6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.
1. With full pressure in the system, command valve closed.
 2. Use an ultra-sonic flow meter to detect flow or leakage.

3.06 TEST PROCEDURES - GENERAL

- A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.
- B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.
- C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:
 - 1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
 - 2. Sampling is not allowed for:
 - a. Major equipment.
 - b. Life-safety-critical equipment.
 - c. Prefunctional Checklist execution.
 - 3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
 - 4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
 - 5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
 - 6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
 - 7. If YY percent of the units in the second sample fail, test all remaining identical units.
 - 8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Subcontractor responsible for Work to perform and document a checkout of the remaining units prior to continuing testing.
- D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").
- E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.
- F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.
- G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.
- H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.
- I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:
 - 1. All points that are monitored by the relevant control system shall be trended by Construction Manager; at the Commissioning Authority's request, Construction Manager shall trend up to 20 percent more points than specified at no extra charge.
 - 2. Other points will be monitored by the Commissioning Authority using dataloggers.

3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
5. Graphical output is desirable and is required for all output if the system can produce it.
6. Monitoring may be used to augment manual testing.

3.07 OPERATION AND MAINTENANCE MANUALS

- A. See Section 017800 - Closeout Submittals for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner through Construction Manager.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Construction Manager and Owner.

END OF SECTION 019113

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SECTION 024100 DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.
- C. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- C. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- D. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- E. Section 030100 - Maintenance of Concrete

1.03 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Site Plan: Indicate:
 - 1. Vegetation to be protected.
 - 2. Areas for temporary construction and field offices.
 - 3. Areas for temporary and permanent placement of removed materials.
- C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
 - 1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SELECTIVE DEMOLITION

- A. Refer to Demolition Plans on Drawings.
- B. Remove and securely store items indicated on Drawings for salvage, relocation, and recycling.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 4. Provide, erect, and maintain temporary barriers and security devices.

5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 7. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
 8. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Protect existing structures and other elements to remain in place and not removed.
1. Provide bracing and shoring.
 2. Prevent movement or settlement of adjacent structures.
 3. Stop work immediately if adjacent structures appear to be in danger.
- E. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- F. Hazardous Materials:
1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
1. Verify construction and utility arrangements are as indicated.
 2. Report discrepancies to Architect before disturbing existing installation.
 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.
- C. Remove existing work as indicated and required to accomplish new work.
1. Remove items indicated on drawings.

- D. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.
- E. Protect existing work to remain.
 - 1. Prevent movement of structure. Provide shoring and bracing as required.
 - 2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch to match new work.

3.05 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 024100

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**SECTION 030100
MAINTENANCE OF CONCRETE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Where required in existing areas:
 - 1. Cleaning of existing concrete surfaces.
 - 2. Repair of exposed structural, shrinkage, and settlement cracks.
 - 3. Resurfacing of concrete surfaces having spalled areas and other damage.

1.02 RELATED REQUIREMENTS

- A. Section 035400 - Cast Underlayment: Cast underlayment for leveling existing concrete surfaces for floor finish.

1.03 REFERENCE STANDARDS

- A. ACI 563 - Specifications for Repair of Concrete in Buildings, 2018.
- B. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturers' instructions for storage, shelf life limitations, and handling of products.
- B. Store materials in covered, well-ventilated area and according to manufacturer's written storage instructions. Store polymer resins and hardeners separate from construction materials that can absorb odors.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

- A. Clean concrete to be repair in compliance with ACI 563. Materials that may be used include:
 - 1. Degreaser. Where used, use products from one of the following manufacturers:
 - a. Manufacturers:
 - 1) Euclid Chemical Company; Euco Clean and Strip: www.euclidchemical.com/#sle.
 - 2) L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; CITREX: www.lmcc.com/#sle.
 - 3) Nox-Crete, Inc; Bio-Clean Plus: www.nox-crete.com/#sle.
 - 4) SpecChem, LLC; Orange Peel-Citrus Cleaner: www.specchemllc.com/#sle.
 - 5) United Gilsonite Laboratories; DRYLOK® Concrete Cleaner and Degreaser: www.ugl.com/#sle.
 - 6) W. R. Meadows, Inc: www.wrmeadows.com/#sle.
 - 2. Detergent: Non-ionic detergent.
 - 3. Alkaline Cleaning Agent.
 - 4. Acidic Cleaning Agent:
 - 5. Strippers and Cleaners for Removal of Existing Coatings:

2.02 PATCHING AND REPAIR MATERIALS

- A. Patch and repair concrete in compliance with ACI 563
- B. Manufacturers:

1. Adhesives Technology Corporation: www.atcepoxy.com/#sle.
2. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
3. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
4. Euclid Chemical Company: www.euclidchemical.com/#sle.
5. Kaufman Products Inc: www.kaufmanproducts.net/#sle.
6. Mapei Corporation: www.mapei.com/#sle.
7. Master Builders Solutions: www.master-builders-solutions.com/en-us/#sle.
8. The QUIKRETE Companies: www.quikrete.com/#sle.
9. SpecChem, LLC: www.specchemllc.com/#sle.
10. W. R. Meadows, Inc: www.wrmeadows.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Coordinate with Section 035400 to verify maintenance of concrete surfaces or use of cast underlayment for floor preparation in existing facilities to be renovated.
- B. Verify that surfaces are ready to receive work.
- C. Beginning of installation means acceptance of substrate.

3.02 PREPARATION

- A. Prepare concrete surfaces to be repaired according to ICRI 310.2R.

3.03 CLEANING EXISTING CONCRETE

- A. Provide enclosures, barricades, and other temporary construction as required to protect adjacent work from damage.
- B. Clean concrete surfaces of dirt or other contamination using the gentlest method that is effective.
 1. Try the gentlest method first, then, if not clean enough, use a less gentle method taking care to watch for impending damage.
 2. Clean out cracks and voids using same methods.
- C. The following are acceptable cleaning methods, in order from gentlest to less gentle:
 1. Water washing using low-pressure, maximum of 100 psi, and, if necessary, brushes with natural or synthetic bristles.
 2. Increasing the water washing pressure to maximum of 400 psi.
 3. Adding detergent to washing water; with final water rinse to remove residual detergent.
 4. Steam-generated low-pressure hot-water washing.
- D. Do not use any of the following cleaning methods, unless otherwise indicated:
 1. Brushes with wire bristles, grinding with abrasives, solvents, hydrochloric or muriatic acid, sodium hydroxide, caustic soda, or lye.
 2. Soap or detergent that is not non-ionic.

3.04 CONCRETE SURFACE REPAIR USING CEMENTITIOUS MATERIALS

- A. Clean concrete surfaces, cracks, and joints of dirt, laitance, corrosion, and other contamination using method(s) specified above and allow to dry.
- B. Apply coating of bonding agent to entire concrete surface to be repaired.
- C. Fill voids with cementitious mortar flush with surface.
- D. Apply repair mortar by steel trowel to a minimum thickness of 1/4 inch over entire surface, terminating at a vertical change in plane on all sides.
- E. Trowel finish to match adjacent concrete surfaces.

END OF SECTION 030100

**SECTION 030516
UNDERSLAB VAPOR BARRIER**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sheet vapor barrier under concrete slabs on grade.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.03 REFERENCE STANDARDS

- A. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting 2018.
- B. ASTM D1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method 2016a, with Editorial Revision (2017).
- C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- D. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.
- E. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017 (Reapproved 2023).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products.
- C. Samples: Submit samples of underslab vapor barrier to be used.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Underslab Vapor Barrier: Composite vapor barrier laminated with non-woven geo-textile fabric.
 - 1. Water Vapor Permeance: Not more than 0.010 perms, maximum, ASTM E96/E96M.
 - 2. Complying with ASTM E1745 Class A.
 - 3. Puncture Resistance: 5210 grams minimum, ASTM D1709.
 - 4. Tensile Strength: 136 lbs/in, minimum, ASTM D882.
 - 5. Thickness: 31 mils minimum.
 - 6. Manufacturers
 - a. Basis of Design: Inteplast Group; Barrier-Bac VB-350: www.barrierbac.com/#sle.
 - b. Henry Company: www.henry.com/#sle.
 - c. ISI Building Products: www.isibp.com/#sle.
 - d. Stego Industries LLC: www.stegoindustries.com/#sle.
 - e. Tex-Trude, LP: www.tex-trude.com/#sle.
 - f. W. R. Meadows, Inc: www.wrmeadows.com/#sle.
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.
- C. Screed Pads: Cast aluminum, 3 inches diameter with 1/2 inch diameter male threads; Use as feet under screed posts to avoid puncturing of under-slab vapor retarder during concrete installation.
 - 1. Basis of Design: Concrete Formworks Screed Pads
<https://concreteformworkaccessories.com/products/screed-pads>

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.02 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.
- C. Lap joints minimum 6 inches.
- D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
- F. Repair damaged vapor retarder before covering with other materials.
 - 1. Patch any and all penetrations according to manufacturer's written recommendations including penetration caused by form stakes.

END OF SECTION 030516

SECTION 032000
CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Steel reinforcement bars.
 2. Welded-wire reinforcement.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
1. Review the following:
 - a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction contraction and isolation joints.
 - c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Each type of steel reinforcement.
 2. Epoxy repair coating.
 3. Zinc repair material.
 4. Bar supports.
 5. Mechanical splice couplers.
- B. Shop Drawings: Comply with ACI SP-066:
1. Include placing drawings that detail fabrication, bending, and placement.
 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
 3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
1. Location of construction joints is subject to approval of Architect.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Statements: For testing and inspection agency.
- B. Welding certificates.
1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.
- C. Material Test Reports: For the following, from a qualified testing agency:
1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.
 2. Mechanical splice couplers.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
 - 1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: As indicated.
- B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.
- D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
- C. Mechanical Splice Couplers: as indicated, same material of reinforcing bar being spliced.
- D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 - 2. Stagger splices in accordance with ACI 318.
 - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.

4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.
- G. Install welded-wire reinforcement in longest practicable lengths.
 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 4. Lace overlaps with wire.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 1. Place joints perpendicular to main reinforcement.
 2. Continue reinforcement across construction joints unless otherwise indicated.
 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

END OF SECTION 032000

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**SECTION 033511
CONCRETE FLOOR FINISHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid densifiers and hardeners for use in Detention Area.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.06 FIELD CONDITIONS

- A. Do not finish floors until interior heating system is operational.
- B. Maintain ambient temperature of 50 degrees F minimum.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide five-year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 DENSIFIERS AND HARDENERS

- A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores, hardening, and dustproofing.
 - 1. Composition: Sodium silicate.
 - a. Properties:
 - 1) Hardening: When tested according to ASTM C39/C39M:
 - (a) After seven days: Minimum 40 percent increase over untreated samples.
 - (b) After twenty-eight days: Minimum 38 percent increase over untreated samples.
 - 2) Abrasion Resistance: Minimum 32 percent improvement over untreated samples when tested according to ASTM C779/C779M.
 - b. Products: Provide Basis of Design product or a comparable product by one of the following:
 - 1) Basis of Design: Curecrete Distribution, Inc; Ashford Formula: www.curecrete.com/#sle.
 - 2) Euclid Chemical Company; EUCO DIAMOND HARD: www.euclidchemical.com/#sle.
 - 3) Mapei Corporation; Mapecrete Hard SB: www.mapei.com/#sle.
 - 4) W. R. Meadows, Inc; Liqui-Hard: www.wrmeadows.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.

- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

- A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION 033511

SECTION 034900
GLASS-FIBER REINFORCED CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural precast glass-fiber-reinforced concrete wall panels.
- B. Supports, anchors, and attachments.

1.02 REFERENCE STANDARDS

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2020).
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished 2018.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- E. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing 2020a.
- F. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric) 2021a.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- H. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement 2022a.
- I. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement 2019.
- J. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.
- K. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.
- L. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- M. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- N. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete 2010a (Reapproved 2016).
- O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019, with Editorial Revision (2022).
- P. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2023, with Editorial Revision.
- Q. ASTM C947 - K. ASTM C947 - Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading) 2016 2016.
- R. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.
- S. ASTM C1228 - Standard Practice for Preparing Coupons for Flexural and Washout Tests on Glass Fiber Reinforced Concrete 2015.
- T. ASTM C1229 - Standard Test Method for Determination of Glass Fiber Content in Glass Fiber Reinforced Concrete (GFRC) (Wash-Out Test) 1994, Revised 2015.
- U. ASTM C1666 - Standard Specification for Alkali Resistant (AR) Glass Fiber for GFRC and Fiber-Reinforced Concrete and Cement 2015.

- V. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.
- W. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- X. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018, with Errata (2022).
- Y. PCI MNL 130 - Manual for Quality Control of Plants and Production of Glass Fiber Reinforced Concrete Products 2006.
- Z. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products 2013.
- AA. PCI MNL-128 - Recommended Practice for Glass Fiber Reinforced Concrete Panels 2001.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.
 - 1. If products submitted are those other than the indicated Basis of Design but from manufacturers listed as acceptable, include a table with a side-by-side comparison of the submitted product and the Basis of Design. Include physical properties and performance data as specified.
- C. Shop Drawings: Show fabrication and installation details for GFRC panels, including the following:
 - 1. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. Panel elevations, sections, and dimensions.
 - 3. Thickness of facing mix, GFRC backing, and bonding pads for typical panels.
 - 4. Finishes.
 - 5. Joint and connection details.
 - 6. Erection details.
 - 7. Panel frame details for typical panels, including sizes, spacings, thicknesses, and yield strengths of various members.
 - 8. Locations and details of connection hardware attached to structure.
 - 9. Size, location, and details of flex, gravity, and seismic anchors for typical panels.
 - 10. Other items sprayed into panels.
 - 11. Erection sequence for special conditions.
 - 12. Relationship to adjacent materials.
 - 13. Descriptions of loose, cast-in, and field hardware.
- D. Samples: Submit two samples 12 inch by 12 inch in size illustrating surface color, finish and texture.
- E. Designer's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Designer Qualifications: Design units under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Idaho.

1.06 PROJECT CONDITIONS

- A. Coordinate the Work with installation of backup supporting structure, windows.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle units to position, consistent with their shape and design. Lift and support only from support points.
- B. Lifting Device: Capable of maintaining unit shape during manufacture, storage, transportation, erection, and in position for fastening.
- C. Blocking and Lateral Support During Transport and Storage: Clean, non-staining, without causing harm to exposed surfaces. Provide temporary lateral support to prevent bowing and warping. Place spacers in same location during transport and site storage.
- D. Protect edges of units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass-Fiber-Reinforced Concrete:
 - 1. Basis of Design: GFRC Cladding: www.gfrcladding.com/#sle.
 - 2. Advanced Architectural Stone: www.advancedarchitecturalstone.com/#sle.
 - 3. Betons Prefabriques de Lac Inc.; <https://www.bpd.com/>.
 - 4. Building Blocks Kissimmee; <https://www.buildingblocks.com/>.
 - 5. Clark Pacific - Adelanto; <https://www.clarkpacific.com/>
 - 6. David Kucera Inc.; <https://www.dkiconcrete.com/>
 - 7. Dura Art Stone - Tecate Plant; <http://duraartstone.com/>
 - 8. Stabil Concrete Products; <https://www.stabilconcrete.com/>
 - 9. Walters & Wolf Precast; <https://waltersandwolf.com/>
 - 10. Willis Construction Company, Inc.; <https://willisconstruction.com/>
 - 11. Willis De Mexico - Tecate Plant; <https://willisconstruction.com/>

2.02 GLASS-FIBER-REINFORCED CONCRETE UNITS

- A. Glass-Fiber-Reinforced Concrete Units: Factory-fabricated, using rigid molds, constructed to maintain unit panel uniform in shape, size and finish.
 - 1. Source Limitations: Obtain GFRC panels through one source from a single manufacturer.
 - 2. Comply with PCI MNL-128 and PCI MNL 130.
 - 3. Design and fabricate to comply with applicable codes.
 - 4. Design to withstand dead loads, positive and negative wind loads, and erection forces.
 - 5. Control deflection of units to maintain fit with adjacent construction and openings within their tolerances.
 - 6. Design connections to accommodate building movement without damage to components, racking of joint connections, breakage of seals, or moisture penetration.
 - 7. Allow for adjustment of connections to accommodate misalignment of structure without permanent distortion.
 - 8. Concrete Mix: Of strength to accommodate panel configuration, panel size and weight, and manufacturing criteria, air entrained.
 - 9. Welding: Comply with AWS D1.1/D1.1M and .AWS D1.3/D1.3M.
 - 10. Structural Steel Members : Comply with AISI S100.
 - 11. Appearance: Ensure exposed-to-view finish surfaces of units are uniform in color and appearance.
 - 12. Finish of Exposed-to-View Precast Unit Surfaces: Sand blasted to light exposures.

2.03 MATERIALS

- A. Concrete Materials:
 - 1. Cement: ASTM C150/C150M Portland Type I - Normal, II - Moderate Sulfate Resistant, or III - igh early strength; white color.
 - a. For surfaces exposed to view in finished structure, use white of same type, brand, and source throughout GFRC production.

2. Concrete Facing Aggregates: ASTM C33/C33M, except for gradation and PCI MNL 130, 1/4 inch maximum size.
 - a. Selected, hard, and durable; free of material that reacts with cement or causes staining to match sample
3. Reinforcement: Alkali resistant chopped glass fiber rovings specifically formulated for use in concrete, with lengths varying from 1-1/2 to 2 inches.
4. Polymer Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.
5. Chemical Admixtures: Comply with ASTM C494/C494M; containing not more than 0.1 percent chloride ions.
6. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
 - a. Synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant
 - b. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).
- B. Sand: Fine, clean, dry silica, free of contaminants, complying with ASTM C144; passing a No. 20 sieve with a maximum of 2 percent passing a No. 100 sieve.
- C. Glass Fiber: Alkali resistant, with minimum zirconia content of 16 percent; not less than 1-1/2 inches long, specifically products for use in GFRC and complying with PCI MNL 130 ASTM C1666
 1. Minimum 16 percent zirconia content.
- D. Water: Potable, Complying with chemical limits of PCI MNL 130.

2.04 FRAMING AND REINFORCING MATERIALS

- A. Metal Framing Members: AISI S100, formed from hot-dipped galvanized steel sheet, ASTM A653/A653M, SS Grade 50 (340) Class 1, with G60/Z180 coating.
 1. Not less than 0.0538 inch thick; stiffened flanges, u-shaped steel track.
- B. Painted, Nonmetallic-Coated Steel Sheet: ASTM A1011/A1011M hot rolled or ASTM A1008/A1008M cold rolled; nonmetallic coated according to ASTM A1003/A1003M; of grade required by structural performance of framing.
- C. Steel Tubing: ASTM A500/A500M, Grade B, or ASTM A513/A513M, primed.
- D. Steel Sections and Miscellaneous Steel: ASTM A36/A36M.
 1. Yield strength: 36 ksi, minimum.
 2. Ultimate Tensile Strength: 58 ksi.
- E. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.
 1. Galvanized in accordance with ASTM A767/A767M, Class II, grade 40.

2.05 GFRC MIXES

- A. Backing Mix: Proportion backing mix of portland cement, glass fibers, sand, and admixtures to comply with design requirements. Provide nominal glass-fiber content of not less than 5 percent by weight of total mix.
- B. Face Mix: Proportion face mix of portland cement, fine and coarse aggregates, and admixtures to comply with design requirements.
- C. Mist Coat Mix: Portland cement, sand slurry, and admixtures, of same proportions as backing mix without glass fibers.
- D. Polymer Curing Admixture: 6 to 7 percent by weight of polymer curing admixture solids to dry portland cement.
- E. Coloring Admixture: Not to exceed 5 percent of cement weight.

2.06 SURFACE FINISH MATERIALS

- A. Surface Finish Aggregate: Comply with sample available for inspection at office of Architect.

2.07 SUPPORT DEVICES

- A. Connecting and Support Devices: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.
- B. Head Stud Embed Anchors: ASTM A108, with a minimum yield strength of 50 ksi, and an ultimate tensile strength of 60 ksi, minimum.
- C. Bolts, Nuts, and Washers: ASTM F3125/F3125M heavy hex structural bolts, Type 1, with matching ASTM A563/A563M nuts, and washers as follows:

2.08 ACCESSORIES

- A. Reglets: Manufacturer's standard.

2.09 FABRICATION

- A. Panel Frame Fabrication:
 - 1. Fabricate panel frames and accessories plumb, square, true to line, and with components securely fastened.
 - a. Fabricate panel frames using jigs or templates.
 - b. Cut cold-formed metal framing members by sawing or shearing; do not torch cut.
 - c. Fasten cold-formed metal framing members by welding. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - d. Fasten framing members of hollow structural sections, steel channels, or steel angles by welding. Comply with AWS D1.1/D1.1M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - e. Weld flex, gravity, and seismic anchors to panel frames.
 - 2. Reinforce, stiffen, and brace framing assemblies, if necessary, to withstand handling, delivery, and erection stresses. Lift fabricated assemblies in a manner that prevents damage or significant distortion.
 - 3. Galvanizing Repair: Touch up accessible damaged galvanized surfaces according to ASTM A780/A780M.
 - 4. Painting Repair: Touch up accessible damaged painted surfaces using same primer.
- B. Mold Fabrication:
 - 1. Construct molds that will result in finished GFRC complying with profiles, dimensions, and tolerances indicated, without damaging GFRC during stripping. Construct molds to prevent water leakage and loss of cement paste.
 - 2. Coat contact surfaces of molds with form-release agent. B. Locate, place and secure flashing reglets accurately.
- C. GFRC Fabrication:
 - 1. Proportioning and Mixing: For backing mix, meter sand/cement slurry and glass fibers to spray head at rates to achieve design mix proportions and glass-fiber content according to PCI MNL 130 procedures.
 - 2. Spray Application:
 - a. Spray mist coat over molds to a nominal thickness of 1/8 inch on planar surfaces.
 - b. Spray or place face mix in thickness indicated on approved Shop Drawings.
 - c. 3. Proceed with spraying backing mix before mist or face coat has set, to produce uniform thickness and even distribution of glass fibers and matrix.
 - d. Consolidate backing mix to achieve complete encapsulation of glass fibers and compaction.
 - e. Measure thickness for each 5 square feet of panel surface not less than six measurements per panel.

2.10 SOURCE QUALITY CONTROL

- A. Manufacture ring and Fabrication: Quality Control Program in compliance with PCI MNL-117 and PCI MNL 130.
 - 1. Test materials and inspect production techniques.
 - 2. Monitor glass fiber content, spray rate, unit weight, product physical properties, anchor pull-off and shear strength, and curing period and conditions.
 - 3. Prepare test specimens and test according to ASTM C1228, PCI MNL-128, and PCI MNL 130 procedures.
 - 4. Produce test boards at a rate not less than one per work shift machine and for each mix design.
 - a. For each test board, determine glass fiber content according to ASTM C1229, and flexural yield and ultimate strength according to ASTM C947.

2.11

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.02 PREPARATION

- A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 INSTALLATION

- A. Coordinate installation with structural supports, backup, and opening framing, if any.
- B. Install units without damage to shape or finish. Replace or repair damaged panels.
- C. Install units level and plumb within allowable tolerances.
- D. Align and maintain uniform horizontal and vertical joints as erection progresses.
- E. When units require adjustment beyond design or tolerance criteria, discontinue affected work and advise Architect.
- F. Site cutting of panels not permitted.
- G. Fasten units in place with mechanical connections.

3.04 TOLERANCES

- A. Maximum Variation from Plane of Location: 1/4 inch in 10 feet and 3/8 inch in 100 feet, non-cumulative.
- B. Maximum Offset from True Alignment Between Two Connecting Units: 1/4 inch.
- C. Maximum Out of Square: 1/8 inch in 10 feet, non-cumulative.
- D. Variation From Dimensions Indicated on Shop Drawings: Plus or minus 1/8 inch.
- E. Maximum Misalignment of Anchors, Inserts, Openings: 1/8 inch.
- F. Bowing of Units: Length of Unit/360.
- G. Exposed Joint Dimension: 1/2 inch plus or minus 1/4 inch.

3.05 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.
- B. Perform tests and inspections in accordance with PCI MNL 130.

3.06 CLEANING

- A. Clean units according to manufacturer's written instructions.
 - 1. Remove dirt, stains, and residue.

2. Protect adjacent materials during cleaning.

3.07 PROTECTION

- A. Protect installed units from damage.

END OF SECTION 034900

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**SECTION 035400
CAST UNDERLAYMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid-applied self-leveling floor underlayment.
 - 1. Use gypsum-based type at where required to provide level surface of existing concrete for installation of new flooring.

1.02 RELATED REQUIREMENTS

- A. Section 030100 - Maintenance of Concrete: Cleaning and repair of existing concrete flooring.

1.03 REFERENCE STANDARDS

- A. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete 2020.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- D. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair 2013.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.
- C. Manufacturer's Instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Keep dry and protect from direct sun exposure, freezing, and ambient temperature greater than 105 degrees F.

1.06 FIELD CONDITIONS

- A. Do not install underlayment until floor penetrations and peripheral work are complete.
- B. Maintain minimum ambient temperatures of 50 degrees F 24 hours before, during and 72 hours after installation of underlayment.
- C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Gypsum Underlayment:
 - 1. Arcosa Specialty Products; Accrete: www.acgmaterials.com/#sle.
 - 2. ARDEX Engineered Cements; ARDEX K 22 F with ARDEX P51 Primer: www.ardexamericas.com/#sle.
 - 3. Maxxon Corporation; Gyp-Crete 2000/3.2K: www.maxxon.com/#sle.
 - 4. USG; Levelrock® Series 2500 Floor Underlayment: www.usg.com/#sle.

2.02 MATERIALS

- A. Cast Underlayments, General:
 - 1. Comply with applicable code for combustibility or flame spread requirements.

2. Provide certificate of compliance from authority having jurisdiction indicating approval of underlayment materials in the required fire rated assembly.
- B. Gypsum-Based Underlayment: Gypsum based mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
1. Compressive Strength: Minimum 2,000 to 3,200 pounds per square inch, tested per ASTM C472.
 2. Density: Maximum 110 to 120 pounds per cubic foot.
 3. Final Set Time: 1 to 2 hours, maximum.
 4. Thickness: 3/4 inch to maximum 3-1/2 inch.
 5. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 in accordance with ASTM E84.
- C. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch in size and acceptable to underlayment manufacturer for thickness required.
- D. Reinforcement: Galvanized metal lath complying with written recommendations of underlayment manufacturer for specific project circumstances.
- E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.
- F. Primer: Manufacturer's recommended type.
- G. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.
- H. Surface Sealer: As recommended in writing by manufacturer for type of floor covering to be applied to underlayment.

2.03 MIXING

- A. Site mix materials in accordance with manufacturer's instructions.
- B. Add aggregate for areas where thickness will exceed 1/2 inch. Mix underlayment and water for at least two minutes before adding aggregate, and continue mixing to assure that aggregate has been thoroughly coated.
- C. Mix to self-leveling consistency without over-watering.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Coordinate with Section 030100 to verify maintenance of concrete surfaces or use of cast underlayment for floor preparation in existing facilities to be renovated.
- B. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.02 PREPARATION

- A. Concrete: Mechanically prepare steel troweled concrete to create a textured surface necessary to achieve the best bond; acceptable methods include bead blasting and scarifying. Do not use acid etching.
- B. Concrete: Prepare surfaces according to ICRI 310.2R.
- C. Wood: Install metal lath for reinforcement of underlayment.
- D. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- E. Vacuum clean surfaces.
- F. Prime substrate in accordance with manufacturer's instructions. Allow to dry.
- G. Close floor openings.

3.03 APPLICATION

- A. Install underlayment in accordance with manufacturer's instructions.

- B. Pump or pour material onto substrate. Do not retemper or add water.
 - 1. Pump, move, and screed while the material is still highly flowable.
 - 2. Be careful not to create cold joints.
 - 3. Wear spiked shoes while working in the wet material to avoid leaving marks.
- C. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft.
- D. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

3.04 CURING

- A. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
- B. Air cure in accordance with manufacturer's instructions.

3.05 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field inspection and testing, as specified in Section 014000 - Quality Requirements.
- B. Placed Material: Agency will inspect and test for compliance with specification requirements.

END OF SECTION 035400

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**SECTION 042000
UNIT MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clay facing brick.
- B. Mortar.
- C. Reinforcement and anchorage.
- D. Flashings.
- E. Lintels.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 042200 - Concrete Masonry Units.
- B. Section 047200 - Cast Stone Masonry: Cast stone masonry.
- C. Section 071900 - Water Repellents: Siloxane water repellents applied to unit masonry.
- D. Section 072500 - Weather Barriers: Water-resistive barriers applied to exterior face of backing sheathing or unit masonry substrate.
- E. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
- C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- E. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2022.
- F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.
- G. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile 2023.
- H. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2022.
- I. ASTM C91/C91M - Standard Specification for Masonry Cement 2023.
- J. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- K. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- L. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes 2018.
- M. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale) 2022.
- N. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.
- O. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
- P. ASTM C476 - Standard Specification for Grout for Masonry 2023.

- Q. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry 2019a.
- R. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing 2017 (Reapproved 2023).
- S. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber 2020.
- T. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.
- U. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls 2017.
- V. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls 2005.
- W. BIA Technical Notes No. 46 - Maintenance of Brick Masonry 2017.
- X. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, masonry accessories, joint reinforcement, anchors, ties, and metal accessories.
- C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
 - 1. Include calculations or selections from the manufacturer's prescriptive design tables that indicate compliance with the applicable building code and project conditions.
- D. Samples:
 - 1. Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.
 - 2. Joint Reinforcement.
 - 3. Anchors, ties, and metal access

1.06 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.07 MOCK-UPS

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, reinforcement, flashings (with lap joint, corner, and end dam), and weather barrier in mock-up.
- B. Locate where directed.
- C. If, approved, mock-up may remain as part of work.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

PART 2 PRODUCTS

2.01 BRICK UNITS

- A. Manufacturers: Provide product indicated on Drawings, or a comparable Architect approved product by one of the following:

1. Belden Brick: www.beldenbrick.com/#sle.
 2. Endicott Clay Products Co: www.endicott.com/#sle.
 3. Basis of Design: Interstate Brick: www.interstatebrick.com/#sle.
 4. Meridian Brick LLC; : www.meridianbrick.com/#sle.
- B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
1. Color and texture: As indicated on Drawings.
 2. Nominal size: As indicated on drawings.
 3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
 4. Compressive strength: As indicated on drawings, measured in accordance with ASTM C67/C67M.
 5. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67/C67M.
 6. Efflorescence: Provide brick that has been tested according to ASTM C67/C67M and is rated "not effloresced."

2.02 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91/C91M, Type N.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
1. Not more than 0.60 percent alkali.
- C. Hydrated Lime: ASTM C207, Type S.
- D. Mortar Aggregate: ASTM C144.
- E. Grout Aggregate: ASTM C404.
- F. Water: Clean and potable.
- G. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
1. Type: Type N.
 2. Color: Davis Colors; Sandstone 0.75 LB 5237 or Pebble 0.5 LB 641.
 - a. Final selection by architect at time of submittal.

2.03 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
1. Blok-Lok Limited: www.blok-lok.com/#sle.
 2. Hohmann & Barnard, Inc: www.h-b.com/#sle.
 3. WIRE-BOND www.wirebond.com/#sle.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Truss or ladder.
 2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
 3. Size: 0.1875 inch side rods with 0.1875 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
- E. Strap Anchors: Bent steel shapes, 1-1/2 inch width, 0.105 inch thick, 24 inch length, with 1-1/2 inch long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.

- F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
 - 1. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
- G. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 - 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 - 2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
 - 3. Vertical adjustment: Not less than 3-1/2 inches.
 - 4. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.

2.04 FLASHINGS

- A. Metal Flashing Materials:
 - 1. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.
 - 2. Prefabricated Metal Flashing: Smooth fabricated 12 oz/sq ft stainless steel (type 304) flashing for surface mounted conditions.
 - a. Manufacturers:
 - 1) Cheney Flashing Company: www.cheneyflashing.com/#sle.
 - 2) Hohmann & Barnard, Inc: www.h-b.com/#sle.
- B. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
- C. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.05 ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or polyvinyl chloride.
- B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt.)
- C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
 - 1. Full-Height Airspace Maintenance and Drainage Material: Mesh panels fitted between masonry ties.
 - a. Drainage Material Thickness: 3/8 inch.
 - b. Manufacturers:
 - 1) Advanced Building Products, Inc; Mortairvent-CW: www.advancedbuildingproducts.com/#sle.
 - 2) CavClear, a Division of Archovations Inc; CavClear Masonry Mat: www.cavclear.com/#sle.
- D. Weeps:
 - 1. Type: Polyester mesh.
 - 2. Color(s): As selected by Architect from manufacturer's full range.
 - 3. Manufacturers:
 - a. Advanced Building Products, Inc: www.advancedbuildingproducts.com/#sle.
 - b. Blok-Lok Limited: www.blok-lok.com/#sle.
 - c. CavClear, a Division of Archovations Inc: www.cavclear.com/#sle.

- d. Mortar Net Solutions; WeepVent: www.mortarnet.com/#sle.
- E. Self-adhering membrane material patches and through wall flashing, 40 mil thick,
- F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 LINTELS

- A. Brickwork Support System: Offset steel relief angles or lintels with hanger brackets for support of brickwork above horizontal masonry joints and openings to allow insulation to span continuously behind brick and eliminate continuous thermal bridges associated with support systems that interrupt continuous insulation.
 - 1. Component and anchorage as indicated on the Structural Drawings.
 - 2. Materials: Steel, hot dip galvanized to ASTM A153/A153M class B.

2.07 MORTAR AND GROUT MIXING

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
 - 1. Masonry below grade and in contact with earth: Type S.
 - 2. Exterior, loadbearing masonry: Type N.
 - 3. Exterior, non-loadbearing masonry: Type N.
 - 4. Interior, non-loadbearing masonry: Type O.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

- A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Brick Units:
 - 1. Bond: Running.
 - 2. Coursing: As indicated on Drawings.
 - 3. Mortar Joints: As indicated on Drawings.

3.05 PLACING AND BONDING

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- D. Remove excess mortar and mortar smears as work progresses.
- E. Interlock intersections and external corners.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

- A. Install weeps in veneer wall at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls. Install weeps in masonry head joints

3.07 CAVITY MORTAR CONTROL

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 24 inch 24 inches each side of opening.
- C. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 24 inches horizontally and 24 inches vertically.
 - 1. Apply strip/patch of self-adhering membrane to weather resistant barrier at anchor faster locations
- F. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

- A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 36 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- C. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.10 MASONRY FLASHINGS

- A. Install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
 - 1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at nonmasonry construction.
- B. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.
- C. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.
- D. Support flexible flashings across gaps and openings.
- E. Extend flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.
 - 1. Strip-in sheet metal flashing to weather resistant barrier with self-adhering through wall flashing membrane
- F. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.11 LINTELS

- A. Install loose steel lintels over openings as indicated on Structural Drawings..
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
 - 1. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
 - 2. Place and consolidate grout fill without displacing reinforcing.
 - 3. Allow masonry lintels to attain specified strength before removing temporary supports.
- C. Install thermal brick support system in accordance with manufacturer's instructions at locations indicated on drawings

3.12 CONTROL AND EXPANSION JOINTS

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
- C. Size control joints as indicated on drawings; if not indicated, 3/4 inch wide and deep.
- D. Form expansion joint as detailed on drawings.

3.13 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
 - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.14 TOLERANCES

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.15 CUTTING AND FITTING

- A. Cut and fit for chases. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.16 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 014000 - Quality Requirements.

3.17 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

3.18 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 042000

SECTION 042200
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Concrete masonry units.
 2. Mortar and grout.
 3. Steel reinforcing bars.
 4. Masonry-joint reinforcement.
 5. Miscellaneous masonry accessories.

1.2 DEFINITIONS

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

1.3 PREINSTALLATION MEETINGS

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

1.4 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.
 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Verification: For each type and color of the following:

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
B. 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. Cementitious materials. Include name of manufacturer, brand name, and type.
 3. Mortar admixtures.
 4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
 5. Grout mixes. Include description of type and proportions of ingredients.
 6. Reinforcing bars.
 7. Joint reinforcement.
 8. Anchors, ties, and metal accessories.
- C. 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 in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
 2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.
- D. 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 in accordance with TMS 602/ACI 530.1/ASCE 6.

- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.

1.7 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.

1.8 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.
- 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/ACI 530.1/ASCE 6.
 - 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/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 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.

2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
 - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) in accordance with TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 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.

2.4 CONCRETE MASONRY UNITS

- A. Integral Water Repellent: Provide units made with integral water repellent for exposed units.
 - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
- B. CMUs: ASTM C90.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength as indicated on drawings.
 - 2. Density Classification: Medium weight.
 - 3. Size (Width): Manufactured to dimensions **3/8 inch** less-than-nominal dimensions.
 - 4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
 - a. Basis-of-Design: Basalite Concrete Products – 762 (Sable) Ground Face.

2.5 MASONRY LINTELS

- A. General: Provide the following:
- B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, 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 is not more than 0.1 percent when tested in accordance with ASTM C114.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

- D. Masonry Cement: ASTM C91/C91M.
- E. Mortar Cement: ASTM C1329/C1329M.
- F. Aggregate for Mortar: ASTM C144.
 - 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 C404.
- H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
- J. Water: Potable.

2.7 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: as indicated on drawings..
- 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.
- C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.
 - 1. Interior Walls: **Mill-** galvanized carbon steel.
 - 2. Exterior Walls: **Hot-dip galvanized carbon** steel.
 - 3. Wire Size for Side Rods: **0.187-inch** diameter.
 - 4. Wire Size for Cross Rods: **0.187-inch** diameter.
 - 5. Spacing of Cross Rods: Not more than 16 inches o.c.
 - 6. Provide in lengths of not less than 10 feet, **with prefabricated corner and tee units.**

2.8 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
- B. Application: Unless otherwise indicated, use the following:
 - 1. Where flashing is indicated to receive counterflashing, use metal flashing.
 - 2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
 - 3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
- C. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 1. Solder for Stainless Steel: ASTM B32, **[Grade Sn60] [Grade Sn96]**, with acid flux of type recommended by stainless steel sheet manufacturer.
- D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D1056, 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 D2000, 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 D226/D226M, Type I (No. 15 asphalt felt).

2.10 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 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 C270, Property 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 reinforced masonry, use Type S.
 - 2. 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.
- D. Grout for Unit Masonry: Comply with ASTM C476.
 - 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C476, 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 in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 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 would impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses to accommodate items specified in this and other Sections.
- B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- C. 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.

3.3 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.
- 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.

3.4 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 bond pattern 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.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow 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.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 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 **corners**, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry wall lengths greater than 25ft as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. 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.

3.8 LINTELS

- A. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.
- B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY

- 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 other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- 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/ACI 530.1/ASCE 6 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 is done at Contractor's expense.
- B. Inspections:As indicated on drawings..
 - 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: One set of tests.
- D. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140 for compressive strength.
- E. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.
- F. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

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. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.12 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

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**SECTION 047200
CAST STONE MASONRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Architectural cast stone.

1.02 RELATED REQUIREMENTS

- A. Section 042200 - Concrete Masonry Units.
- B. Section 042000 - Unit Masonry: Installation of cast stone in conjunction with masonry.
- C. Section 079200 - Joint Sealants: Sealing joints indicated to be left open for sealant.

1.03 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Structural Concrete 2019 (Reapproved 2022).
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- D. ASTM A580/A580M - Standard Specification for Stainless Steel Wire 2018.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.
- F. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire 2019.
- G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- H. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement 2019.
- I. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement 2019, with Editorial Revision (2020).
- J. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2022.
- K. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.
- L. ASTM C33/C33M - Standard Specification for Concrete Aggregates 2018.
- M. ASTM C73 - Standard Specification for Calcium Silicate Brick (Sand-Lime Brick) 2022.
- N. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.
- O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete 2019, with Editorial Revision (2022).
- P. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete 2021.
- Q. ASTM C1364 - Standard Specification for Architectural Cast Stone 2023.
- R. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry 2019a.
- S. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data:

1. Test results of cast stone components made previously by the manufacturer.
 - a. Include one copy of ASTM C1364 for Architect's use.
2. Joint reinforcement
3. Anchors, ties, and metal accessories.
- C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.
- D. Mortar Color Selection Samples.
- E. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.
- F. Full-Size Samples, For Review:
 1. Basic Shapes: One of each color.
- G. Source Quality Control Test Reports.
- H. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
 2. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UP

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Approved mock-up will become standard for appearance and workmanship.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.
- B. Number each piece individually to match shop drawings and schedule.
- C. Store cast stone components and installation materials in accordance with manufacturer's instructions.
- D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.
- E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.
- F. Store mortar materials where contamination can be avoided.
- G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Architectural Cast Stone:
 1. Basis of Design: Arriscraft International, Inc.: www.arriscraft.com/#sle.
 2. Other manufacturers with prior approval.

2.02 ARCHITECTURAL CAST STONE

- A. Cast Stone: Architectural concrete product manufactured by vibrant dry tamped method to simulate appearance of natural stone, complying with ASTM C1364.
 - 1. Grade SW, ASTM C73,
 - 2. Modular Size: As indicated on Drawings.
 - 3. Performance:
 - a. Compressive Strength: 4,000 psi minimum or as specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
 - b. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
 - 4. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
 - 5. Color: To be selected by Architect from the following:
 - a. Sandstone 0.75 LB 5237
 - b. Pebble 0.5 LB 641. Final selection by architect at time of submittal. As scheduled on Drawings.
 - c. Final selection by architect at time of submittal.
 - 6. Remove cement film from exposed surfaces before packaging for shipment.
- B. Shapes: Provide shapes indicated on drawings.
 - 1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
 - 2. Unless otherwise indicated on drawings, provide:
 - a. Wash or slope of 1:12 on exterior horizontal surfaces.
 - b. Drips on projecting components, wherever possible.
 - c. Raised fillets at back of sills and at ends to be built in.
- C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.03 MORTAR MIXES

- A. At Contractor's option, mortar may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
- B. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Type: Type N.
 - 2. Color: Mineral pigments added as required to produce approved color sample.
- C. Mortar Color: Natural gray unless otherwise indicated.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

2.04 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers:
 - 1. Blok-Lok Limited: www.blok-lok.com/#sle.
 - 2. Hohmann & Barnard, Inc: www.h-b.com/#sle.
 - 3. WIRE-BOND www.wirebond.com/#sle.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.
- C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
 - 1. Type: Truss or ladder.
 - 2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.

3. Size: 0.1875 inch side rods with 0.1875 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
- D. Strap Anchors: Bent steel shapes, 1-1/2 inch width, 0.105 inch thick, 24 inch length, with 1-1/2 inch long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.
- E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
 1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
 2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
 3. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.

2.05 FLASHING

- A. Metal Flashing Materials:
 1. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.
 2. Prefabricated Metal Flashing: Smooth fabricated 12 oz/sq ft stainless steel (type 304) flashing for surface mounted conditions.
 - a. Manufacturers:
 - 1) Cheney Flashing Company: www.cheneyflashing.com/#sle.
 - 2) Hohmann & Barnard, Inc: www.h-b.com/#sle.

2.06 ACCESSORIES

- A. Weeps:
 1. Type: Polyester mesh.
 2. Color(s): As selected by Architect from manufacturer's full range.
 3. Manufacturers:
 - a. Advanced Building Products, Inc: www.advancedbuildingproducts.com/#sle.
 - b. Blok-Lok Limited: www.blok-lok.com/#sle.
 - c. CavClear, a Division of Archovations Inc: www.cavclear.com/#sle.
 - d. Mortar Net Solutions; WeepVent: www.mortarnet.com/#sle.

2.07 MATERIALS

- A. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.
- B. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.
- C. Admixtures: ASTM C494/C494M.
- D. Water: Potable.
- E. Reinforcing Bars: ASTM A615/A615M, Grade 40 (40,000 psi), deformed bars, galvanized.
 1. Galvanized in accordance with ASTM A767/A767M, Class I.
- F. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.
- G. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.
- H. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.
- I. Joint Sealant: Embedded sand silicone joint sealant.
- J. Clear Sealer: Compatible with substrate, and as recommended in writing by cast stone manufacturer.

- K. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.08 SOURCE QUALITY CONTROL

- A. Test compressive strength and absorption of specimens selected at random from plant production.
 - 1. Test in accordance with ASTM C642.
 - 2. Select specimens at rate of 3 per 500 cubic feet, with a minimum of 3 per production week.
 - 3. Submit reports of tests by independent testing agency, showing compliance with requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.
- B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Install cast stone components in conjunction with masonry, complying with requirements of Section 042000.
- C. Mechanically anchor each cast stone unit.
- D. Setting:
 - 1. Drench cast stone components with clear, running water immediately before installation.
 - 2. Set units in a full bed of mortar unless otherwise indicated.
 - 3. Fill vertical joints with mortar.
 - 4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.03 REINFORCEMENT AND ANCHORAGE - CAST STONE MASONRY

- A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.
- C. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.04 MASONRY FLASHINGS

- A. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.
- B. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.
- C. Support flexible flashings across gaps and openings.
- D. Extend flashings to within 1/2 inch of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.
 - 1. Strip-in sheet metal flashing to weather resistant barrier with self-adhering through wall flashing membrane

- E. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.05 WEEPS/CAVITY VENTS

- A. Install weeps in cast stone masonry wall at 24 inches on center horizontally on top of through-wall flashing at bottom of walls. Install weeps in masonry head joints
- B. Install cavity vents in cast stone masonry walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

3.06 TOLERANCES

- A. Joints: Make all joints 3/8 inch, except as otherwise detailed.
 - 1. Rake mortar joints 3/4 inch for pointing.
 - 2. Remove excess mortar from face of stone before pointing joints.
 - 3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
 - 4. Leave the following joints open for sealant:
 - a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
 - b. Joints in projecting units.
 - c. Joints between rigidly anchored units, including soffits, panels, and column covers.
 - d. Joints below lugged sills and stair treads.
 - e. Joints below ledge and relieving angles.
 - f. Joints labeled "expansion joint".
- B. Installation Tolerances:
 - 1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.
 - 2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.
 - 3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.
 - 4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.07 REPAIR

- A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
- B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.
- C. Repair methods and results subject to Architect 's approval.

3.08 CLEANING

- A. Clean completed exposed cast stone after mortar is thoroughly set and cured.
 - 1. Wet surfaces with water before applying cleaner.
 - 2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
 - 3. Remove cleaner promptly by rinsing thoroughly with clear water.
 - 4. Do not use acidic cleaners.

3.09 PROTECTION

- A. Protect completed work from damage.
- B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION 047200

SECTION 051200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Structural-steel materials.
 2. Shrinkage-resistant grout.
 3. Prefabricated building columns.
 4. Shear stud connectors.

1.2 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "LFRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
1. Shapes included in ASTM A6/A6M with flanges thicker than 1-1/2 inches.
 2. Welded built-up members with plates thicker than 2 inches.
 3. Column base plates thicker than 2 inches.
- D. Protected Zone: Structural members or portions of structural members indicated as "protected zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand-Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system and which are indicated as "demand critical" or "seismic critical" on Drawings.

1.3 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 anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

- A. Product Data:
1. Structural-steel materials.
 2. High-strength, bolt-nut-washer assemblies.
 3. Shear stud connectors.
 4. Anchor rods.
 5. Threaded rods.
 6. Forged-steel hardware.
 7. Shop primer.
 8. Galvanized-steel primer.
 9. Etching cleaner.
 10. Galvanized repair paint.
 11. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Include embedment Drawings.
 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
 5. Identify members and connections of the seismic-load-resisting system.
 6. Indicate locations and dimensions of protected zones.
 7. Identify demand-critical welds.
 8. Identify members not to be shop primed.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
 2. Electrode manufacturer and trade name, for demand-critical welds.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, professional engineer, testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural-steel materials, including chemical and physical properties.
- E. Product Test Reports: For the following:
 1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 2. Direct-tension indicators.
 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 4. Shear stud connectors.
- F. Survey of existing conditions.
- G. Source quality-control reports.
- H. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172), or other approved qualifications.
- B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
- C. Shop-Painting Applicator Qualifications: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3.
- D. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
 1. Welders and welding operators performing work on bottom-flange, demand-critical welds are to pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G are to be considered separate processes for welding personnel qualification.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 1. ANSI/AISC 303.
 2. ANSI/AISC 341.
 3. ANSI/AISC 360.
 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Shear wall system.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: as indicated.
- B. Channels, Angles, M-Shapes: as indicated.
- C. Channels, Angles, S-Shapes: as indicated.
- D. Plate and Bar: as indicated.
- E. Cold-Formed Hollow Structural Sections: as indicated.
- F. Steel Pipe: as indicated.
- G. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.
- H. Steel Forgings: ASTM A668/A668M.
- I. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
 1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490 Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
 1. Direct-Tension Indicators: ASTM F959/F959M, Type 490-1, compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 1. Finish: Hot-dip or mechanically deposited zinc coating.
 2. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.

- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Plain.
- E. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

- A. Unheaded Anchor Rods: as indicated.
 - 1. Configuration: Straight.
 - 2. Nuts: ASTM A563 hex carbon steel.
 - 3. Plate Washers: ASTM A36/A36M carbon steel.
 - 4. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 5. Finish: Plain.
- B. Headed Anchor Rods: as indicated, straight.
 - 1. Nuts: ASTM A563 hex carbon steel.
 - 2. Plate Washers: ASTM A36/A36M carbon steel.
 - 3. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 4. Finish: Plain.
- C. Threaded Rods: ASTM A36/A36M.
 - 1. Nuts: ASTM A63 hex carbon steel.
 - 2. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 3. Finish: Plain.

2.5 FORGED-STEEL STRUCTURAL HARDWARE

- A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.
- B. Eye Bolts and Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1030.
- C. Sleeve Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1018.

2.6 PRIMER

- A. Steel Primer:
 - 1. Comply with **Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."**
 - 2. SSPC-Paint 23, latex primer.
 - 3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanized-Steel Primer: **MPI#80**.
 - 1. Etching Cleaner: MPI#25, for galvanized steel.
 - 2. Galvanizing Repair Paint: **ASTM A780/A780M**.

2.7 SHRINKAGE-RESISTANT GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.8 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 - 1. Camber structural-steel members where indicated.

2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.
- F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- H. Welded-Steel Door Frames: Build up welded-steel doorframes attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated on Drawings.
- I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.9 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: as indicated.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.10 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
 2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.
 3. Any steel fully or partially outside the building's weather barrier or membrane.

2.11 SHOP PRIMING

- A. Shop prime steel surfaces, except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches
 2. Surfaces to be field welded.
 3. Surfaces of high-strength bolted, slip-critical connections.
 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
 5. Galvanized surfaces unless indicated to be painted.
 6. Surfaces enclosed in interior construction.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
1. SSPC-SP 2.
 2. SSPC-SP 3.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner or in accordance with SSPC-SP 16.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.12 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94/E94M.
 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
 - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
 5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates..
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack shrinkage-resistant 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 grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 - 1. Joint Type: as indicated.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.
- C. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.5 REPAIR

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 2. Cleaning and touchup painting are specified in **Section 099113 "Exterior Painting."** And **Section 099123 "Interior Painting."**
- C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections as indicated in the Drawings.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

END OF SECTION 051200

SECTION 052100
STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. K-series steel joists.
 2. LH-series long-span steel joists.
 3. CJ-series composite steel joists.
 4. Steel joist girders.
 5. Steel joist accessories.

1.2 DEFINITIONS

- A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."
- B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product.
- B. Shop Drawings:
1. Include layout, designation, number, type, location, and spacing of joists.
 2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
 3. Indicate locations and details of bearing plates to be embedded in other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and professional engineer.
- B. Welding certificates.
- C. Manufacturer certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Mill Certificates: For each type of bolt.
- F. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.
- G. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."
1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.
- B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.7 SEQUENCING

- A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.
 - 1. Use ASD; data are given at service-load level.
 - 2. Design special joists to withstand design loads with live-load deflections no greater than the following:
 - a. Floor Joists: Vertical deflection of 1/360 of the span.
 - b. Roof Joists: Vertical deflection of 1/240 of the span.

2.2 STEEL JOISTS

- A. K-Series Steel Joist: Manufactured steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
 - 1. Joist Type: K-series steel joists.
 - 2. Provide holes in chord members for connecting and securing other construction to joists.
 - 3. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."
 - 4. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated on Drawings, complying with SJI's "Specifications."
 - 5. Camber joists as indicated on Drawings.
 - 6. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.
- B. Long-Span Steel Joist: Manufactured steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as indicated on Drawings.
 - 1. Provide holes in chord members for connecting and securing other construction to joists.
 - 2. Camber long-span steel joists as indicated on Drawings.
 - 3. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.
- C. Composite Steel Joist: Manufactured steel joists according to "Standard Specifications for Composite Steel Joists, CJ-Series" in SJI's "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," with steel-angle top- and bottom-chord members and parallel top chord, and with square ends.
 - 1. Camber composite steel joists as indicated on Drawings.
 - 2.

2.3 PRIMERS

- A. Primer:
 - 1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
 - 2. Provide shop primer that complies with **Section 099123 "Interior Painting."**

2.4 STEEL JOIST ACCESSORIES

- A. Bridging:
 - 1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel

- Joists, Weight Tables and Bridging Tables, Code of Standard Practice" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.
- B. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated on Drawings.
 - C. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."
 - D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.
 - 1. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.
 - 2. Finish: **Primed and painted.**
 - E. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Plain.
 - F. Welding Electrodes: Comply with AWS standards.
 - G. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 or ASTM A780/A780M.
 - H. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 **CLEANING AND SHOP PAINTING**

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by **hand-tool cleaning, SSPC-SP 2.**
- B. Do not prime paint joists and accessories **to receive sprayed fire-resistive materials.**
- C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.
- D. Shop priming of joists and joist accessories is specified in **Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."**

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications" and "Standard Specification for Composite Steel Joists, CJ-Series" in "Standard Specifications for Composite Steel Joists, Weight Tables and Bridging Tables, Code of Standard Practice," joist manufacturer's written 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. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.
- C. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and

procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

- D. Bolt joists to supporting steel framework using carbon-steel bolts.
- E. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.
- F. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 REPAIRS

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.
- B. Touchup Painting:
 - 1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, **bearing plates, abutting structural steel**, and accessories.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
 - b. Apply a compatible primer of same type as primer used on adjacent surfaces.
 - 2. Cleaning and touchup painting are specified in **Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."**

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Visually inspect field welds according to AWS D1.1/D1.1M.
- C. Visually inspect bolted connections.
- D. Prepare test and inspection reports.

END OF SECTION 052100

**SECTION 053100
STEEL DECKING**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Roof deck.
 - 2. Composite floor deck.

1.2 ACTION SUBMITTALS

- A. Product Data:
 - 1. Roof deck.
 - 2. Composite floor deck.
- B. Shop Drawings:
 - 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of steel deck.
- C. Test and Evaluation Reports:
 - 1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
 - a. Power-actuated mechanical fasteners.
 - 2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.
- D. Field Quality-Control Submittals:
 - 1. Field quality-control reports.
- E. Qualification Statements: For welding personnel and testing agency.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes:
 - 1. AWS D1.1/D1.1M.
 - 2. AWS D1.3/D1.3M.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store products in accordance with SDI MOC3. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.
- B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

2.2 ROOF DECK

- A. Fabrication of Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with SDI RD and with the following:
1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade **50** minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - a. Color: **Manufacturer's standard**.
 2. Deck Profile: As indicated.
 3. Profile Depth: As indicated Design Uncoated-Steel Thickness: As indicated.
 5. Span Condition: Triple span or more.
 6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 COMPOSITE FLOOR DECK

- A. Fabrication of Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with SDI C, with the minimum section properties indicated, and with the following:
1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade **50** minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard **gray or white** baked-on, rust-inhibitive primer.
 2. Profile Depth: As indicated.
 3. Design Uncoated-Steel Thickness: As indicated.
 4. Span Condition: Triple span or more.

2.4 ACCESSORIES

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI standards for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- J. Galvanizing Repair Paint: [**ASTM A780/A780M**] [**SSPC-Paint 20 or MIL-P-21035B, with dry film containing a minimum of 94 percent zinc dust by weight**].
- K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories in accordance with SDI C, SDI NC, and SDI RD, as applicable; manufacturer's written instructions; and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install in accordance with deck manufacturer's written instructions.
- J. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: **[5/8 inch (16 mm)] [3/4 inch (19 mm)]**, nominal.
 - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and **weld or mechanically fasten** flanges to top of deck. Space attachment not more than 12 inches apart with at least one attachment at each corner.
 - 1. Install reinforcing channels or zees in ribs to span between supports and **weld or mechanically fasten**.
- E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels in accordance with deck manufacturer's written instructions. **Weld or mechanically fasten** to substrate to provide a complete deck installation.
 - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive in accordance with manufacturer's written instructions to ensure complete closure.

3.4 INSTALLATION OF FLOOR DECK

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
 - 1. Weld Diameter: **3/4 inch** nominal.
 - 2. Weld Spacing:
 - a. Space and locate welds as indicated.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:
 - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
 - 2. Mechanically clinch or button punch.
 - 3. Fasten with a minimum of 1-1/2-inch- long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of **1-1/2 inches**, with end joints as follows:
 - 1. End Joints: Lapped.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure in accordance with SDI recommendations unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, in accordance with SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.
- B. Repair Painting:
 - 1. Wire brush and clean rust spots, welds, and abraded areas on **both surfaces** of prime-painted deck immediately after installation, and apply repair paint.
 - 2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
 - 3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
 - a. Field welds will be subject to inspection.
 - 2. Steel decking will be considered defective if it does not pass tests and inspections.
 - 3. Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

- b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors that are already tested.
- C. Prepare test and inspection reports.

END OF SECTION 053100

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SECTION 054000
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Exterior non-load-bearing wall framing.
 2. Interior non-load-bearing wall framing.
 3. Soffit framing.
- B. Related Requirements:
1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
 2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.
 3. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
1. Cold-formed steel framing materials.
 2. Exterior non-load-bearing wall framing.
 3. Interior non-load-bearing wall framing.
 4. Vertical deflection clips.
 5. Single slotted track.
 6. Soffit framing.
 7. Post-installed anchors.
 8. Power-actuated anchors.
 9. Sill sealer gasket.
 10. Sill sealer gasket.
- B. Shop Drawings:
1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Certificates: For each type of code-compliance certification for studs and tracks.
- D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.

6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- E. Research Reports:
1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
 2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.
- 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/D1.3M, "Structural Welding Code - Sheet Steel."
- E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: as indicated.
 2. Coating: **G60** or equivalent.
- B. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
 2. Coating: **G60**.

2.2 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: as indicated.
 2. Flange Width: as indicated.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: as indicated.
 2. Flange Width: as indicated.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Slotted Track: Manufacturer's single, deep-leg, U-shaped steel track; punched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: as indicated.
 2. Flange Width: as indicated.

2.3 INTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: as indicated.
 - 2. Flange Width: as indicated.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: as indicated.
 - 2. Flange Width: as indicated.
- C. Vertical Deflection Clips: Manufacturer's standard **bypass head** clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection or Slotted Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: as indicated.
 - 2. Flange Width: as indicated.

2.4 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: as indicated.
 - 2. Flange Width: as indicated..

2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Hole-reinforcing plates.
 - 10. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
 2. Type: Torque-controlled expansion anchor, Torque-controlled adhesive anchor or adhesive anchor.
 3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593 and nuts, ASTM F594.
- D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.
- 2.7 MISCELLANEOUS MATERIALS**
- A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B or SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.
- F. Sill Sealer Gasket/Termite Barrier: Minimum 68-mil nominal thickness, self-adhering sheet consisting of 64 mils (1.6 mm) of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side.
1. Physical Properties:
 - a. Peel Adhesion: 17.0 lb/in of width when tested in accordance with ASTM D412.
 - b. Low-Temperature Flexibility: Pass at minus 25 deg F when tested in accordance with ASTM D146/D146M.
 - c. Water Vapor Permeance: 0.05 perm maximum when tested in accordance with ASTM E96/E96M, Method B.
 - d. Resistance to Termite Penetration: Comply with ICC-ES AC380.
- 2.8 FABRICATION**
- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
1. Fabricate framing assemblies using jigs or templates.
 2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.
- C. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 1. Cut framing members by sawing or shearing; do not torch cut.
 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire

integrated supporting structure has been completed and permanent connections to framing are secured.

- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: as indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing infill studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated, but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within **12 inches** of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at as indicated.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: as indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to studs and anchor to building structure.
 4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within **12 inches** of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking as indicated.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

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**SECTION 055000
METAL FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Shop fabricated steel items.

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- D. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- H. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.
- J. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.
- K. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

1.04 QUALITY ASSURANCE

- A. Design elevator hoist beams under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in Idaho.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- D. Slotted Channel Fittings: ASTM A1011/A1011M.
- E. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

- A. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.
- B. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.04 FINISHES - STEEL

- A. Prime paint steel items.
 - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

2.05 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on shop drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.

- F. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 055000

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SECTION 055113
METAL PAN STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Preassembled steel stairs with field pour concrete-filled treads.
 2. Steel tube railings attached to metal stairs.
 3. Steel tube handrails attached to walls adjacent to metal stairs.
 4. Safety gate.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs and railings.
1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings so wall attachments are made only to completed walls.
1. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs and the following:
1. Abrasive nosings.
 2. Shop primer products.
 3. Nonslip-aggregate concrete finish.
 4. Handrail wall brackets.
 5. Grout.
- B. Shop Drawings:
1. Include plans, elevations, sections, details, and attachments to other work.
 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
 3. Include plan at each level.
 4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.

1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification.
 - 1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
 - 2. Protect steel members and packaged materials from corrosion and deterioration.
 - 3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components 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 A36/A36M.
- C. Steel Tubing for Railings: ASTM A513/A513M.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, either commercial steel, Type B, or structural steel, Grade 25, unless another grade is required by design loads; exposed.

2.2 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls.
 - 1. Select fasteners for type, grade, and class required.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
- E. Post-Installed Anchors: Torque-controlled expansion 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 E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.3 MISCELLANEOUS MATERIALS

- A. Handrail Wall Brackets: As indicated on drawings.
- B. Welding Electrodes: Comply with AWS requirements.
- C. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
- D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- E. Zinc-Rich Primer: Comply with SSPC-Paint 20, Type II, Level 2, and compatible with topcoat.

- F. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for exterior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.

2.4 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs and railings in shop to greatest extent possible.
 - 1. Disassemble units only as necessary for shipping and handling limitations.
 - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections 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. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 - 2. Locate joints where least conspicuous.
 - 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 - 4. Provide weep holes where water may accumulate internally.

2.5 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Architectural Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers as indicated on Drawings.
 - a. Stringer Size: As indicated on Drawings.
 - b. Provide closures for exposed ends of channel and rectangular tube stringers.
 - c. Finish: Painted.
 - 2. Platforms: Construct of steel channel or steel rectangular tube headers and miscellaneous framing members as indicated on Drawings .
 - a. Provide closures for exposed ends of channel and rectangular tube framing.
 - b. Finish: Painted.

- C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness as indicated on Drawings.
 - 1. Steel Sheet: Uncoated, cold -rolled steel sheet.
 - 2. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication. Reinforcing as indicated on Drawings.
 - 3. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

2.6 FABRICATION OF STAIR RAILINGS

- A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."
- B. Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
 - 1. Rails and Posts: See drawings.
- C. Welded Connections: Fabricate railings with welded connections.
 - 1. Cope components at connections to provide close fit, or use fittings designed for this purpose.
 - 2. Weld all around at connections, including at fittings.
 - 3. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 4. Obtain fusion without undercut or overlap.
 - 5. Remove flux immediately.
 - 6. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of a welded joint as shown in NAAMM AMP 521.
- D. Form changes in direction of railings as follows:
 - 1. As detailed.
 - 2. By inserting prefabricated elbow fittings.
- E. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- F. Close exposed ends of railing members with prefabricated end fittings.
- G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
 - 1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- H. Connect posts to stair framing by direct welding unless otherwise indicated.
- I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
 - 1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 2. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
 - 3. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
 - 4. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.
- J. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.

1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.7 FINISHES

- A. Finish metal stairs after assembly.
- B. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints.
 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 2. 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.
 3. Comply with requirements for welding in "Fabrication, General" Article.
- E. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

3.3 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
 1. Space posts at spacing indicated or, if not indicated, as required by design loads.
 2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet.
 3. Align rails so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet.
 4. Secure posts and rail ends to building construction as follows:
 - a. Anchor posts to steel by welding to steel supporting members.
 - b. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.
- B. Install railing gates level, plumb, and secure for full opening without interference.
 1. Attach hardware using tamper-resistant or concealed means.
 2. Adjust hardware for smooth operation.

- C. Attach handrails to wall with wall brackets.
 - 1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
 - 2. Secure wall brackets to building construction as required to comply with performance requirements.
 - a. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.

3.4 REPAIR

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with 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. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 055113

**SECTION 055133
METAL LADDERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prefabricated ladders.

1.02 REFERENCE STANDARDS

- A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.
- K. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.
- L. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 - 1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- F. Bolts, Nuts, and Washers: ASTM A307, plain.
- G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

- I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 PREFABRICATED LADDERS

- A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
 1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
 2. Materials: Carbon steel; ASTM A1011/A1011M Grade 36, minimum.
 3. Finish: Manufacturer's standard hot-dipped galvanizing; comply with ASTM A153/A153M for ladders exposed to weather.
 4. Manufacturers:
 - a. Industrial Ladder & Scaffolding, Inc.: www.anyladder.com/#sle.
 - b. O'Keeffe's Inc: www.okeeffes.com/#sle.
 - c. Precision Ladders, LLC: www.precisionladders.com/#sle.

2.03 FINISHES - STEEL

- A. Prime paint steel items.
 1. Do not prime surfaces in direct contact with concrete.
 2. Do not prime surfaces where field welding is required.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

2.04 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

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

3.03 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 055133

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**SECTION 055213
PIPE AND TUBE RAILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall mounted handrails.
- B. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

- A. Section 042000 - Unit Masonry: Placement of anchors in masonry.
- B. 057100 - Decorative Metal Stairs 057000 - Decorative Metal
- C. Section 092116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- D. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing 2021.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.
- G. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.
- H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- K. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017, with Amendment (2021).
- L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Include the design engineer's seal and signature on each sheet of shop drawings.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.

1.05 QUALITY ASSURANCE

- A. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
 - 1. Top Rails and Wall Rails: 1-1/2 inches diameter, round.
 - 2. Posts: 1-1/2 inches diameter, round.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 - 1. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
 - 2. For anchorage to stud walls, provide backing plates, for bolting anchors.
- G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.
- H. Welded and Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
 - 1. Ease exposed edges to a small uniform radius.
 - 2. Welded Joints:
 - a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
 - b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.

2.02 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.
- C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- D. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- E. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.
- F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 STAINLESS STEEL RAILING SYSTEM

- A. Stainless Steel Components: ASTM A666
- B. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch minimum metal thickness, 1-1/2 inch diameter.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- D. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

- E. Stainless Steel Finish: No. 4 Bright Polished finish.

2.04 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
 - 1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 - 2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
 - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Weld connections that cannot be shop welded due to size limitations.
 - 1. Weld in accordance with AWS D1.1/D1.1M.
 - 2. Match shop welding and bolting.
 - 3. Clean welds, bolted connections, and abraded areas.
 - 4. Touch up shop primer and factory-applied finishes.
 - 5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.
- F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 055213

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**SECTION 057000
DECORATIVE METAL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Railing and guardrail assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 055213 - Pipe and Tube Railings: Exterior stainless steel railings at steps.
- B. Section 057100 - Decorative Metal Stairs.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- C. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods 2022.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings 2020.
- F. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.
- G. AWS C3.4M/C3.4 - Specification for Torch Brazing 2016.
- H. AWS C3.5M/C3.5 - Specification for Induction Brazing 2016, with Amendment (2017).
- I. AWS C3.9M/C3.9 - Specification for Resistance Brazing 2020.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- K. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017, with Amendment (2021).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Pre-Installation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:
 - 1. Contractor.
 - 2. Manufacturer's representative.
 - 3. Architect.
 - 4. Owner's representative.
 - 5. Other subcontractors of adjacent work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.
- C. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
- D. Test Reports: Submit test reports from an independent testing agency showing compliance with specified design and performance requirements.
- E. Maintenance Data: Manufacturer's instructions for care and cleaning.
- F. Manufacturer's qualification statement.
- G. Designer's Qualification Statement.

- H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in Idaho, or personnel under direct supervision of such an engineer.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
 - a. Safety Glazing Certification Council (SGCC).

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in factory-provided protective coverings and packaging.
- B. Protect materials against damage during transit, delivery, storage, and installation at site.
- C. Inspect materials upon delivery for damage. Repair damage to be indistinguishable from undamaged areas; if damage cannot be repaired to be indistinguishable from undamaged parts and finishes, replace damaged items.
- D. Prior to installation, store materials and components under cover in a dry location.

1.08 FIELD CONDITIONS

- A. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F and maximum 95 degrees F.
- B. Maintain ambient temperature of space at minimum 65 degrees F and maximum 95 degrees F for 24 hours before, during, and after railing installation.

1.09 WARRANTY

- A. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 RAILING SYSTEMS

- A. Railing Systems - General: Factory- or shop-fabricated in design indicated, to suit specific project conditions, and for proper connection to building structure, and in largest practical sizes for delivery to site.
 - 1. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 - Quality Requirements to design railings, including attachment to building construction.
 - 2. Performance Requirements: Design and fabricate railings and anchorages to resist the following loads without failure, damage, or permanent set; loads do not need to be applied simultaneously.
 - a. Lateral Force: 75 lb minimum, at any point, when tested in accordance with ASTM E935.
 - b. Distributed Load: 50 lb/ft minimum, applied in any direction at the top of the handrail, when tested in accordance with ASTM E935.
 - c. Concentrated Loads on Intermediate Rails: 50 psf, minimum.
 - d. Concentrated Load: 200 lbs minimum, applied in any direction at any point along the handrail system, when tested in accordance with ASTM E935.
 - 3. Assembly: Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on non-weld mechanical fittings, flanges, escutcheons, and wall brackets.
 - 4. Joints: Tightly fitted and secured, machined smooth with hairline seams.
 - 5. Field Connections: Provide sleeves to accommodate site assembly and installation.

6. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
 - a. Ease exposed edges to a small uniform radius.
 - b. Welded Joints:
 - 1) Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
 - 2) Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.
 - c. Brass/Bronze Brazed Joints:
 - 1) Perform torch brazing in accordance with AWS C3.4M/C3.4.
 - 2) Perform induction brazing in accordance with AWS C3.5M/C 3.5.
 - 3) Perform resistance brazing in accordance with AWS C3.9M/C3.9.
- B. Metal Railing: Engineered, post-supported railing system.
 1. Grip Rail: Round, stainless steel, 1-1/2 inch diameter.
 2. Decorative Flanges for Embedded Posts: Circular, collared cover plate without screw holes.
 3. Wall Mounted Components: Components necessary to support railing with 1-1/2 inch clearance from wall, and as follows:
 4. Fasteners: Concealed.
 5. Infill at Cable Railings: Stainless steel cable.
 - a. Material: ASTM A666, Type 304.
 - b. Mounting: Mechanically attached to frame.
 6. End and Intermediate Posts: As shown on drawings.
 - a. Horizontal Spacing: As indicated on drawings.
 - b. Mounting: Welded.
 7. Basis of Design: Viva Railings, LLC; CIRCA: www.vivarailings.com/#sle.
- C. Cable Railing System:
 1. Description: Post and cable railing system.
 2. Configuration: Guardrail only.
 3. Stainless Steel Tube: Type 304 stainless steel.
 - a. Top Rail: 1-1/2 inch outside diameter.
 4. Cable: ASTM A555/A555M.
 - a. Fabricate from ASTM A666 stainless steel, Type 304.
 - b. Size: 3/16 inch diameter.
 5. Fittings: Type 304 stainless steel, non-swedge.
 6. Fasteners: Stainless steel.
 7. Finishes:
 - a. Exposed Stainless Steel Pipe and Tubing: No. 4 bright finish.
 8. Fabrication:
 - a. Corners: Mitered and welded; grind smooth to match adjacent finish.
 - b. Exposed Joints: Butt tight and flush.
 - c. Splices: Provide interior sleeves; fasteners allowed at splice connections

2.02 ACCESSORIES

- A. Non-Weld Mechanical Fittings for Stainless Steel Railings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.
- C. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 1. For anchorage to concrete, provide inserts to be cast into concrete for bolt anchors.

2. For anchorage to masonry, provide brackets to be embedded in masonry for bolt anchors.
3. For anchorage to stud walls, provide backing plates for bolt anchors.
4. Exposed Fasteners: No exposed bolts or screws.

D. Carbon Steel Bolts and Nuts: ASTM A307.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate and site conditions are acceptable and ready to receive work.
- B. Verify field dimensions of locations and areas to receive work.
- C. Notify Architect immediately of conditions that would prevent satisfactory installation.
- D. Do not proceed with work until detrimental conditions have been corrected.
- E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates, and supports for attachment of anchors.

3.02 PREPARATION

- A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.
- B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

- A. Comply with manufacturer's drawings and written instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.
- C. Anchor securely to structure.
- D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- E. Weld connections that cannot be shop welded due to size limitations.
 1. Weld in accordance with AWS D1.1/D1.1M.
 2. Match shop welding and bolting.
 3. Clean welds, bolted connections, and abraded areas.
 4. Touch up shop primer and factory-applied finishes.
 5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.
- F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

3.05 CLEANING

- A. Remove protective film from exposed metal surfaces.
- B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

3.06 PROTECTION

- A. Protect installed components and finishes from damage after installation.
- B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.

1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION 057000

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**SECTION 057100
DECORATIVE METAL STAIRS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Decorative metal stairs.

1.02 RELATED REQUIREMENTS

- A. Section 057000 - Decorative Metal: Railing and guardrail assemblies.
- B. Section 093000 - Tiling: Tile infill in treads and landings.
- C. Section 099123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- H. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel 2017, with Amendment (2021).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:
 - 1. Contractor.
 - 2. Architect.
 - 3. Owner's representative.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, anchors, and accessories.
- C. Shop Drawings: Indicate stair plans, elevations, and sections, details of profiles, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
- D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.6/D1.6M no more than 12 months before start of scheduled welding work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in factory-provided protective coverings and packaging.
- B. Protect materials against damage during transit, delivery, storage, and installation at site.
- C. Inspect materials for damage upon delivery. Replace damaged materials that cannot be repaired to be indistinguishable from undamaged parts and finishes.
- D. Prior to installation, store materials and components under cover in a dry location.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Warranty: Manufacturer's standard one year warranty against defects in materials, fabrication, finishes, and installation commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 DECORATIVE METAL STAIRS

- A. Decorative Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings and guards, fabricated for anchorage to each other and to building structure.
 - 1. Regulatory Requirements: Comply with the most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
 - 2. Structural Design: Comply with the following:
 - a. Stair Capacity:
 - 1) Live Load: Uniform live load of 100 lb/sq ft and a maximum concentrated load of 300 lb.
 - 2) Dead Load: Weight of stair, associated railing system, concrete fill, cladding and other finishes.
 - 3) Deflection Limits: Deflection of stringer or landing framing not to exceed 1/360 of span.
 - 3. Configuration and Dimensions: As indicated on drawings.
 - 4. Assembly:
 - a. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
 - b. Eliminate sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
 - c. Separate dissimilar metals using paint or permanent tape.
 - d. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
- B. Metal Jointing and Finish Quality Levels: Architectural, as defined below.
 - 1. Architectural: Inconspicuous joints, whether welded or mechanical.
 - a. Welded Joints: Continuously welded and ground smooth and flush.
 - b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
 - c. Exposed Edges and Corners: Eased to small uniform radius.
 - d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
- C. Provide required fasteners and anchors:
 - 1. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
 - 2. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise.

2.02 COMPONENTS

- A. Treads: Tiling over concrete-filled steel pan treads.
 - 1. Tread Pan Material: Steel sheet.
 - 2. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.
 - 3. Pan Anchorage to Stringers: Welded to carrier angles welded or bolted to stringers.
 - 4. Concrete Finish: For tiling.
- B. Risers: Closed.
- C. Risers: Solid steel sheet.
 - 1. Riser/Nosing Profile: Sloped riser with rounded nosing of radius no greater than 1/2 inch. See Drawings.
 - 2. Nosing Depth: Not more than 1-1/2 inch overhang.
 - 3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.
- D. Stringers: Steel plate.
 - 1. Stringer Depth: As indicated on drawings.
- E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
- F. Railing Systems: See Section 057000.
- G. Finish: Shop- or factory-prime painted.

2.03 MATERIALS

- A. Steel Components:
 - 1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
 - 2. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
 - a. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
 - b. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
- B. Stainless Steel Components:
 - 1. ASTM A666, Type 304.
 - 2. Stainless Steel Finish: No.4 Bright Polished finish.

2.04 ACCESSORIES

- A. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as stair components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
 - 1. For anchorage to concrete, provide inserts to be cast into concrete for bolt anchors.
 - 2. For anchorage to masonry, provide brackets to be embedded in masonry for bolt anchors.
 - 3. For anchorage to stud walls, provide backing plates for bolt anchors.
 - 4. Exposed Fasteners: No exposed bolts or screws.
- B. Steel Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- D. Nosing: Stainless

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate and site conditions are acceptable and ready to receive work.
- B. Verify field dimensions of locations and areas to receive work.
- C. Notify Architect immediately of conditions that would prevent satisfactory installation.
- D. Do not proceed with work until detrimental conditions have been corrected.

- E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates, and supports for attachment of anchors.

3.02 PREPARATION

- A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.
- B. Clean surfaces to receive units. Remove materials and substances detrimental to the installation.

3.03 INSTALLATION

- A. Comply with manufacturer's drawings and written instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.
- C. Anchor securely to structure.
- D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
- E. Weld connections that cannot be shop welded due to size limitations.
 - 1. Weld in accordance with AWS D1.1/D1.1M.
 - 2. Match shop welding and bolting.
 - 3. Clean welds, bolted connections, and abraded areas.
 - 4. Touch up shop primer and factory-applied finishes.
- F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

3.05 CLEANING

- A. Remove protective film from exposed metal surfaces.
- B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

3.06 PROTECTION

- A. Protect installed components and finishes from damage after installation.
- B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.
 - 1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION 057100

**SECTION 061053
MISCELLANEOUS ROUGH CARPENTRY**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted curbs.
- B. Roofing nailers.
- C. Roofing cant strips.
- D. Preservative treated wood materials.
- E. Fire retardant treated wood materials.
- F. Communications and electrical room mounting boards.
- G. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- C. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 2010 (Reapproved 2017).
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- E. AWPA U1 - Use Category System: User Specification for Treated Wood 2023.
- F. PS 1 - Structural Plywood 2019.
- G. PS 20 - American Softwood Lumber Standard 2021.
- H. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17 2018.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
 - 1. Species: Douglas Fir-Larch, unless otherwise indicated.
 - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
 - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 DIMENSION LUMBER

- A. Grading Agency: West Coast Lumber Inspection Bureau; WCLIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.
- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
 - 1. Lumber: S4S, No.2 or Standard Grade.
 - 2. Boards: Standard or No.3.

2.03 CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: PS 1, A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- B. Other Applications:
 - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
 - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
 - 3. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Stainless steel for preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
 - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.
- C. Sill Gasket on Top of Foundation Wall: 1/4 inch thick, plate width, closed cell plastic foam from continuous rolls.

2.05 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
 - 1. Wood installed in Building B to be Fire Treated unless noted otherwise; refer to Sheet G11.
 - 2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat exterior rough carpentry items.
 - c. Do not use treated wood in direct contact with ground.

3. Interior Type A: AWWPA U1, Use Category UCFA, Commodity Specification H, low temperature, low hygroscopic type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
 - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
 - b. Treat rough carpentry items as indicated.
 - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.
- C. Preservative Treatment:
 1. Preservative Pressure Treatment of Lumber Above Grade: AWWPA U1, Use Category UC3B, Commodity Specification A to 0.10 lb/cu ft retention.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with roofing, flashing, or waterproofing.
 - d. Treat lumber in contact with masonry or concrete.
 - e. Treat lumber less than 18 inches above grade.
 2. Preservative Pressure Treatment of Plywood Above Grade: AWWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 - b. Treat plywood in contact with roofing, flashing, or waterproofing.
 - c. Treat plywood in contact with masonry or concrete.
 - d. Treat plywood less than 18 inches above grade.

PART 3 EXECUTION

3.01 PREPARATION

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- B. Install sill gasket under sill plate bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.
- C. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
 1. Offset successive layers of overlapping blocking, nailers, and supports by 12 inches, minimum

3.04 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on 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.

3.06 CLEANING

- A. Waste Disposal:
 - 1. Comply with applicable regulations.
 - 2. Do not burn scrap on project site.
 - 3. Do not burn scraps that have been pressure treated.
 - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 061053

SECTION 064100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Hardware.

1.02 RELATED REQUIREMENTS

- A. Section 064113 - Wood-Veneer-Faced Architectural Cabinets: For architectural cabinets associated with courtroom.
- B. Section 064216 - Flush Wood Paneling: For flush wood paneling associated with courtrooms.
- C. Section 064400 - Ornamental Woodwork: For woodwork in courtrooms.
- D. Section 123600 - Countertops.

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard 2022.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications 2022.
- C. AWI (QCP) - Quality Certification Program Current Edition.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- E. BHMA A156.9 - Cabinet Hardware 2020.
- F. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- G. PS 1 - Structural Plywood 2019.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Provide information as required by AWI/AWMAC/WI (AWS).
 - 2. Include certification program label.
- C. Product Data: Provide data for hardware accessories.
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.05 QUALITY ASSURANCE

- A. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
 - 2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 3. Provide designated labels on shop drawings as required by certification program.
 - 4. Provide designated labels on installed products as required by certification program.
 - 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
 - 6. Replace, repair, or rework all work for which certification is refused.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.07 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 PANEL CORE MATERIALS

- A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.
 - 1. Grade: M-2; moisture resistance: MR10.
- B. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.
 - 1. Grade: 130; moisture resistance: MR10.
- C. Softwood Plywood: DOC PS 1, medium-density overlay.

2.03 THERMALLY FUSED LAMINATE PANELS

- A. Thermally Fused Laminate (TFL): Melamine- or polyester-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
 - 1. Test in accordance with NEMA LD 3 Section 3.
 - 2. Panel Core Substrate: As indicated on Drawings..

2.04 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. Formica Corporation: www.formica.com/#sle.
 - 2. Panolam Industries International, Inc: www.panolam.com/#sle.
 - 3. Wilsonart LLC: www.wilsonart.com/#sle.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as indicated.
 - 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, colors as indicated.
 - 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, colors as indicated.
 - 3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, color as selected.
 - 4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.05 COUNTERTOPS

- A. Countertops: See Section 123600.

2.06 ACCESSORIES

- A. Adhesive: Type recommended in writing by fabricator to suit application.
- B. Edge Banding: PVC edge-banding, 0.12 inch thick; color to match plastic laminate.
- C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

2.07 HARDWARE

- A. Hardware: BHMA A156.9, types types as indicated on Drawings and as recommended in writing by fabricator for quality grade specified.

2.08 FABRICATION

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum 2 feet from sink cut-outs.
 - 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 - 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Mechanically fasten back splash to countertops as recommended in writing by laminate manufacturer at 16 inches on center.

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.

3.02 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use fixture attachments in concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units.
- E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- F. Secure cabinets to floor using appropriate angles and anchorages.
- G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Coordination of AWI inspection:
 - 1. Provide inspection in compliance with AWI (QCP).
 - 2. Notify AWI in writing of schedule for woodwork to be certified, and allow adequate time for inspection.
 - 3. Cooperate with AWI.
 - 4. Allow access to woodwork to be inspected.
- C. Inspection entity is to prepare and submit report of inspection.

3.04 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.05 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 064100

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**SECTION 064113
WOOD-VENEER-FACED ARCHITECTURAL 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. Wood-veneer-faced architectural cabinets, including judge's benches and similar casework.
 - 2. Wood furring, blocking, shims, and hanging strips for installing architectural cabinets that are not concealed within other construction.
 - 3. Shop finishing of architectural cabinets.
- B. Related Requirements:
 - 1. Section 061053 - Miscellaneous Rough Carpentry: For wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
 - 2. Section 064100 - Architectural Wood Casework: For interior architectural wood casework not specified in this Section.
 - 3. Section 062000 - Finish Carpentry: For interior architectural woodwork not specified in this Section.
 - 4. Section 064216 - Flush Wood Paneling: For flush wood paneling not specified in this Section.
 - 5. Section 064400 - Ornamental Woodwork: For ornamental woodwork not specified in this Section.
 - 6. Section 102641 - Bullet Resistant Panels: or bullet resistant panels installed in conjunction with wood-veneer-faced architectural cabinets.
 - 7. Section 123600 - Countertops: For plastic-laminate-clad countertops installed in conjunction with wood-veneer-faced architectural cabinets.
- C. Single Subcontract Responsibilities: Refer to the following Section for single subcontract responsibilities of work in this Section:
 - 1. Section 064400 - Ornamental Woodwork.

1.03 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087100 - Door Hardware to manufacturer of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: For architectural cabinets.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show full-size details.

3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 4. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.
 5. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 6. Apply AWI Quality Certification Program label to Shop Drawings. Shop drawings will not be reviewed until AWI Quality Certification Program certificates have been submitted.
- C. Samples for Verification: For the following:
1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished cabinets.
 3. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and 12 by 12 inches for panels, for each finish system and color.
 - a. Finish entire exposed surface.
 4. Corner Pieces:
 - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
 5. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Certificates: For each type of product.
- C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.
- D. Field quality-control reports.
- E. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
 1. Manufacturer/Installer Letter of Accreditation: Submit a copy of the AWI letter of accreditation for the Manufacturer/Installer that they are currently accredited to label as "Premium Grade" for compliance with all sections of the Quality Standards, including finishing.
 2. Project Certification: Submit a copy of the letter of acceptance from AWI to the Manufacturer/Installer for the project listing the project as eligible for inspection and labeling under the AWI Quality Certification Program.

1.07 QUALITY ASSURANCE

- A. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation. The manufacturer shall have had a minimum of 15 years successful experience in the custom fabrication and installation of architectural woodwork comparable to that shown and specified, be a member of the AWI, maintain an organized quality control program, perform its own in-house veneer lay-up work, and who retains facilities with sufficient capacity and quality to produce the required architectural woodwork without causing delay to the project.
 1. Manufacturer/Installer shall be a certified participant in AWI's Quality Certification Program.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Standards (AWS)", Edition 2, 2014, for grades of interior architectural woodwork, construction, finishes, and other requirements.
 1. Provide AWI Quality Certification Program labels or certificates indicating that woodwork, including installation, complies with requirements of grades specified.
 2. The Contractor, upon award of work, shall register the work under this Section with the AWI Quality Certification Program.

- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups of typical architectural cabinets as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.09 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 PRODUCTS

2.01 ARCHITECTURAL CABINET MANUFACTURERS

- A. Source Limitations: Engage a qualified woodworking firm to assume responsibility for production of architectural cabinets with sequence-matched wood veneers, wood paneling, wood doors with face veneers that are sequence matched with architectural cabinets, and transparent-finished wood doors that are required to be of same species as architectural cabinets.

2.02 CABINETS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of architectural cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide labels and certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.
 - 2. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.03 WOOD CABINETS, JUDGE'S BENCHES, AND SIMILAR CASEWORK FOR TRANSPARENT FINISH

- A. Architectural Woodwork Standards Grade: Premium.
- B. Type of Construction: Frameless.
- C. Door and Drawer-Front Style: Flush overlay.
- D. Wood for Exposed Surfaces:
 - 1. Species: Cherry.
 - 2. Cut: Plain Sliced.

3. Grain Direction: As indicated on Drawings.
 4. Matching of Veneer Leaves: Book Match.
 5. Veneer Matching within Panel Face: Center-balance match.
- E. Semiexposed Surfaces:
1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
 2. Drawer Subfronts, Backs, and Sides: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
 3. Drawer Bottoms: Hardwood plywood stained to match species indicated for exposed surfaces.
- F. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- G. 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.

2.04 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet 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: 8 to 13 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
- C. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
1. MDF: ANSI A208.2, Grade 130.
 2. Particleboard: ANSI A208.1, Grade M-2 or M-3.
 3. Softwood Plywood: DOC PS 1, medium-density overlay.
 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
- D. Plastic-Laminate-Clad Countertops: Refer to Section 123600 - Countertops for plastic-laminate-clad countertops installed as part of wood-veneer-faced architectural cabinets.

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. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.
1. Available Product: Grass No. 3903, or equal.
- C. Pulls for Drawers and Doors: Back mounted, 6-11/16 inches long, and 1-13/32 inch projection. Provide polished finished chrome plated brass or bronze (US26).
1. Available Product: DP128 6-11/16" Round Top Pull by Doug Mockett & Co. Inc., or equal.
- D. Adjustable Shelf Standards and Supports for Heavy Duty Shelves: ANSI/BHMA A156.9, B04102; with shelf brackets, B04112. Provide anochrome on heavy duty steel finish.
1. Available Product: Knape & Vogt No. 87 standards and No. 187 brackets, or equal.
- E. Shelf Rests for Base and Wall Cabinets: ANSI/BHMA A156.9, B04013; Provide nickel plated or anochrome plated brass finish.
1. Available Product: Knape & Vogt 332 ANO, or equal.

- F. Drawer Slides: ANSI/BHMA A156.9.
 - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.
 - a. Type: Full extension.
 - b. Material: Zinc-plated steel with polymer rollers.
 - 2. Pencil Drawer Slides: 45 lbf. Capacity medium duty load rating, 3/4 extension carburized steel ball bearing, side mounting, cold rolled steel slide members and ball retainers, cushioned in and outstops, single movement action, positive stop, bright electro zinc plate finish.
 - a. Available Product: Accuride No. 2006.
 - 3. Keyboard Slide: 75 lbf. Capacity medium duty load rating, full extension carburized steel ball bearing, cold rolled steel slide members and ball retainers, secure in partial or fully extended position, adjustable keyboard platform, black powder-coated finish.
 - a. Available Product: Accuride Cbergo-Tray 300.
 - 4. Box Drawer Slides Less Than 4 Inches Deep: 75 lbf. Capacity medium duty load rating, full extension carburized steel ball bearing, side mounting, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
 - a. Available Product: Accuride No. 2132.
 - 5. Box Drawer Slides Greater Than 4 inches but Less Than 8 Inches Deep: 100 lbf. Capacity medium duty load rating, full extension carburized steel ball bearing, side mounting, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
 - a. Available Product: Accuride No. 3832.
 - 6. File Drawer Slides 8 Inches Deep or More: 150 lbf. Capacity heavy duty load rating, full extension carburized steel ball bearing, rail mounting, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
 - a. Available Product: Accuride No. 4032
 - 7. Trash Bin Slides: 200 lbf. Capacity heavy duty load rating, full extension carburized steel ball bearing, side mounting, cold rolled steel slide members and ball retainers, cushioned in and outstops, detent-in, progressive action, positive stop, bright electro zinc plate finish.
 - a. Available Product: Accuride No. 9301.
- G. Door Locks: ANSI/BHMA A156.11, E07121. Provide bright chromium plated brass or bronze finish.
- H. Drawer Locks: ANSI/BHMA A156.11, E07041. Provide bright chromium plated brass or bronze finish.
- I. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- J. Silencers for Cabinet Doors: Provide felt silencers on jamb, head, and sill strike areas of all cabinet doors; 2 for paired doors, 3 for single doors.
- K. Door Bumpers: Large round clear polyurethane cabinet door bumper cushions with adhesive backing, 1/2-inch diameter by 1/8-inch thick.
- L. Grommets for Cable Passage through Countertops: 2-1/2 inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Product: Subject to compliance with requirements, provide "EDP – EDP Flip-Top Series 2-1/2" Hole" by Doug Mockett and Co., Inc.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for BHMA finish number indicated.
 - 1. Bright Chromium Plated: ANSI/BHMA 625 for brass or bronze base; ANSI/BHMA 651 for steel base.
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.06 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood 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. Bullet Resistant Panels: Refer to Section 102641 - Bullet Resistant Panels for bullet resistant panels installed as part of wood-veneer-faced architectural cabinets.
- D. Quartz Agglomerate Countertops: Refer to Section 123600 - Countertops for quartz agglomerate countertops installed as part of wood-veneer-faced architectural cabinets.

2.07 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate architectural cabinets to dimensions, profiles, and details indicated. Ease edges and corners to 1/16-inch radius unless otherwise indicated.
- C. Complete fabrication, including assembly 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.
 - 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
 - 2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- 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.

2.08 SHOP FINISHING

- A. General: Finish architectural cabinets at manufacturer's 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 cabinets, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces.
 - 2. Gluing of face veneers shall, where possible, be by the hot plate method; glued surfaces shall be in close contact throughout. Glue stains will not be permitted.
 - 3. Grain of all transparent finished wood shall run in the direction shown, or if not shown, as accepted on the shop drawings.
- C. Transparent Finish:
 - 1. Architectural Woodwork Standards Grade: Premium.
 - 2. Finish: System - 2, precatalyzed lacquer.
 - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
 - 4. Staining: Match Architect's sample.

5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 EXECUTION

3.01 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.02 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with cabinet surface.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 2. Install cabinets without distortion so doors and drawers fit openings 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.
 3. Maintain veneer sequence matching of cabinets with transparent finish.
 4. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips, or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- E. Shop Finishes: Touch up finishing after installation of architectural cabinets. Fill nail holes with matching filler.
 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- F. Bullet Resistant Panels: Refer to Section 102641 - Bullet Resistant Panels for bullet resistant panels installed as part of wood-veneer-faced architectural cabinets.
- G. Plastic-Laminate-Clad Countertops: Refer to Section 123600 - Countertops for plastic-laminate-clad countertops installed as part of wood-veneer-faced architectural cabinets.

3.03 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 1. Inspection entity shall prepare and submit report of inspection.

3.04 ADJUSTING AND CLEANING

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

END OF SECTION 064113

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**SECTION 064216
FLUSH WOOD 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. Flush wood paneling.
 - 2. Wood furring, blocking, shims, and hanging strips for installing flush wood paneling that is not concealed within other construction.
 - 3. Shop finishing of flush wood paneling.
- B. Related Requirements:
 - 1. Section 061053 - Miscellaneous Rough Carpentry: For wood furring, blocking, shims, and hanging strips required for installing paneling that is concealed within other construction before paneling installation.
 - 2. Section 062000 - Finish Carpentry: For interior architectural woodwork not specified in this Section.
 - 3. Section 064100 - Architectural Wood Casework: For architectural casework not specified in this Section or in Section 064113 - Wood-Veneer-Faced Architectural Cabinets.
 - 4. Section 064113 - Wood-Veneer-Faced Architectural Cabinets: For wood-veneer-faced architectural cabinets not specified in this Section.
 - 5. Section 064400 - Ornamental Woodwork: For ornamental woodwork not specified in this Section.
- C. Single Subcontract Responsibilities: Refer to the following Section for single subcontract responsibilities of work in this Section:
 - 1. Section 064400 - Ornamental Woodwork.

1.03 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For flush wood paneling.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show details full size.
 - 3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
 - 4. For paneling veneered in fabrication shop, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- C. Samples for Verification: For the following:
 - 1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
 - 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished paneling.
 - 3. Veneer-Faced Panel Products for Transparent Finish: 12 by 12 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For each type of product.
- C. Field quality-control reports.

1.07 QUALITY ASSURANCE

- A. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation. The manufacturer shall have had a minimum of 15 years successful experience in the custom fabrication and installation of architectural woodwork comparable to that shown and specified, be a member of the AWI, maintain an organized quality control program, perform its own in-house veneer lay-up work, and who retains facilities with sufficient capacity and quality to produce the required architectural woodwork without causing delay to the project.
 - 1. Manufacturer/Installer shall be a certified participant in AWI's Quality Certification Program.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Standards (AWS)", Edition 2, 2014, for grades of interior architectural woodwork, construction, finishes, and other requirements.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups of typical paneling as shown on Drawings.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.09 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where paneling 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 paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is 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 PANELING FABRICATORS

- A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of paneling, wood-veneer-faced architectural cabinets, wood trim, and wood doors faced with veneers from same flitches as paneling.

2.02 PANELING, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of flush wood paneling (wood-veneer wall surfacing) indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.03 FLUSH WOOD PANELING (WOOD-VENEER WALL SURFACING)

- A. Grade: Premium.
- B. Wood Species and Cut: Cherry, plain sliced.
- C. Veneer Matching Method:
 - 1. Adjacent Veneer Leaves: Book Match.
 - 2. Within Panel Face: Center-balance match.
- D. Panel-Matching Method: Center-balance match.
- E. Panel Core Construction: Particleboard or MDF, unless otherwise indicated on Drawings.
 - 1. Thickness: 3/4 inch, unless otherwise indicated on Drawings.
- F. Exposed Panel Edges: Inset solid-wood or wood-veneer matching faces.
- G. Panel Reveals: Wood veneer species and cut matching faces.
- H. Assemble panels by gluing and concealed fastening.

2.04 MATERIALS

- A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
- B. Wood Moisture Content: 8 to 13 percent.
- C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
 - 1. MDF: ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2 or M-3.

2.05 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials 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.
 - 1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
 - 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
 - 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.
- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, 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.
 - 2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.

3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
 4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of paneling.
- C. Fire-Retardant Particleboard: Made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E84.
1. For panels 3/4 inch thick and less, comply with ANSI A208.1 for Grade M-2 except for the following minimum properties: modulus of rupture, 1600 psi; modulus of elasticity, 300,000 psi; internal bond, 80 psi; and screw-holding capacity on face and edge, 250 and 225 lbf, respectively.
 2. For panels 13/16 to 1-1/4 inches thick, comply with ANSI A208.1 for Grade M-1 except for the following minimum properties: modulus of rupture, 1300 psi; modulus of elasticity, 250,000 psi; linear expansion, 0.50 percent; and screw-holding capacity on face and edge, 250 and 175 lbf, respectively.
- D. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.

2.06 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood 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.
- C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.

2.07 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. 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.
 1. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.
- C. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, 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.

2.08 SHOP FINISHING

- A. General: Finish paneling 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 paneling, as applicable to each unit of work.
 1. Backpriming: Apply two coats of sealer or primer, compatible with finish coats, to concealed surfaces of paneling.
- C. Transparent Finish:

1. Grade: Premium.
2. Finish: System - 2, pre-catalyzed lacquer.
3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Staining: Match Architect's sample.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

- A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.
- B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch.
- C. Anchor paneling to supporting substrate with concealed panel-hanger clips.
 1. Do not use face fastening unless otherwise indicated.
- D. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. 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 shop applied.

3.03 ADJUSTING AND CLEANING

- A. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.
- B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064216

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**SECTION 064400
ORNAMENTAL WOODWORK**

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 ornamental woodwork, including judge's benches and similar casework.
 - 2. Wood furring, blocking, shims, and hanging strips for installing ornamental woodwork items that are not concealed within other construction.
 - 3. Shop finishing of interior ornamental woodwork.
- B. Related Requirements:
 - 1. Section 064100 - Architectural Wood Casework for interior architectural wood casework not specified in this Section.
 - 2. Section 064113 - Wood-Veneer-Faced Architectural Cabinets: For wood-veneer-faced architectural cabinets not specified in this Section.
 - 3. Section 064216 - Flush Wood Paneling: For flush wood paneling not specified in this Section.
 - 4. Section 081416 - Flush Wood Doors: For flush wood doors installed in conjunction with interior architectural woodwork, flush wood paneling, or ornamental woodwork.
 - 5. Section 102641 - Bullet Resistant Panels: For bullet resistant panels installed in conjunction with ornamental woodwork.
- C. Single Subcontract Responsibilities: Work specified elsewhere that is part of the work of this section includes, but is not limited to, applicable portions of the following:
 - 1. Section 012300 - Alternates: For alternates affecting this section.
 - 2. Section 064023 - Interior Architectural Woodwork.
 - 3. Section 064113 - Wood-Veneer-Faced Architectural Cabinets.
 - 4. Section 064216 - Flush Wood Paneling.
 - 5. Section 081416 - Flush Wood Doors: For flush wood doors indicated to be attached to interior architectural woodwork, flush wood paneling, or ornamental woodwork.
 - 6. Section 102641 - Bullet Resistant Panels: For bullet resistant panels indicated to be attached to ornamental woodwork.
 - 7. Section 123600 - Countertops: For plastic-laminate-clad countertops installed in conjunction with wood-veneer-faced architectural cabinets.

1.03 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior ornamental woodwork can be supported and installed as indicated.

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Composite wood and agrifiber products.
 - 2. Finishing materials and processes.
- B. Shop Drawings: Show location of each item, including the following:
 - 1. Dimensioned plans, elevations, and sections.
 - 2. Attachment devices, and other components.
 - 3. Show full-size details.

4. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
 5. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.
 6. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
 7. Apply AWI Quality Certification Program label to Shop Drawings. Shop drawings will not be reviewed until AWI Quality Certification Program certificates have been submitted.
- C. Samples for Verification:
1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
 2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished ornamental woodwork.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For ornamental woodwork manufacturer and Installer.
- B. Product Certificates: For each type of product.
- C. Evaluation Reports: For fire-retardant-treated wood materials, from ICC-ES.
- D. Field quality-control reports.
- E. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
 1. Manufacturer/Installer Letter of Accreditation: Submit a copy of the AWI letter of accreditation for the Manufacturer/Installer that they are currently accredited to label as "Premium Grade" for compliance with all sections of the Quality Standards, including finishing.
 2. Project Certification: Submit a copy of the letter of acceptance from AWI to the Manufacturer/Installer for the project listing the project as eligible for inspection and labeling under the AWI Quality Certification Program.

1.07 QUALITY ASSURANCE

- A. Single-Source Manufacturing and Installation Responsibility: Engage a qualified Manufacturer to assume undivided responsibility for woodwork specified in this section, including fabrication, finishing, and installation. The manufacturer shall have had a minimum of 15 years successful experience in the custom fabrication and installation of architectural woodwork comparable to that shown and specified, be a member of the AWI, maintain an organized quality control program, perform its own in-house veneer lay-up work, and who retains facilities with sufficient capacity and quality to produce the required architectural woodwork without causing delay to the project.
 1. Manufacturer/Installer shall be a certified participant in AWI's Quality Certification Program.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Standards (AWS)", Edition 2, 2014, for grades of interior architectural woodwork, construction, finishes, and other requirements.
 1. Provide AWI Quality Certification Program labels or certificates indicating that woodwork, including installation, complies with requirements of grades specified.
 2. The Contractor, upon award of work, shall register the work under this Section with the AWI Quality Certification Program.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Mock-ups to be constructed of OSB and will be removed prior to installation of final casework.
 2. Build mockups of typical following items as shown on Drawings.
 - a. Judge's bench.
 - b. Witness stand.
 - c. Mobile witness stand

- d. Jury box.
- 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Architectural Woodwork Standards, Section 2.
- B. Do not deliver interior ornamental woodwork until painting and similar operations that could damage woodwork have been completed in installation areas.
- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.09 FIELD CONDITIONS

- A. Environmental Limitations for Interior Work: Do not deliver or install interior ornamental woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupancy for the remainder of the construction period.
- B. Field Measurements: Where ornamental woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where ornamental woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is 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 ORNAMENTAL WOODWORK MANUFACTURERS

- A. Source Limitations: Engage a qualified woodworking firm to assume responsibility for production of ornamental woodwork, architectural cabinets with sequence-matched wood veneers, wood paneling, wood doors with face veneers that are sequence matched with architectural cabinets, and transparent-finished wood doors that are required to be of same species as architectural cabinets.

2.02 ORNAMENTAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of ornamental woodwork indicated for construction, finishes, installation, and other requirements.
 - 1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
 - 2. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.

2.03 INTERIOR ORNAMENTAL WORK FOR TRANSPARENT FINISH

- A. Interior ornamental work for transparent finish includes the following:
 - 1. Judge's bench.
 - 2. Clerk's station.
 - 3. Court reporter station.
 - 4. Witness stand.
 - 5. Mobile witness stand.
 - 6. Jury box.
 - 7. Attorney's rails and gate.

- B. Architectural Woodwork Standards Grade: Premium.
- C. Wood Veneer Species and Cut:
 - 1. Species: Cherry.
 - 2. Cut: Plain Sliced.
- D. Veneer Matching Method:
 - 1. Adjacent Veneer Leaves: Book Match.
 - 2. Within Panel Face: Center-balance match.
- E. Veneer Matching Method:
 - 1. Adjacent Veneer Leaves: As selected by Architect.
 - 2. Within Panel Face: Center-balance match.
- F. Panel-Matching Method: As indicated on Drawings.
- G. Exposed Panel Edges: Inset solid-wood or wood-veneer matching faces.
- H. Panel Reveals: Wood veneer species and cut matching faces.
- I. Solid Wood Lumber Species and Cut:
 - 1. Species: To be determined.
 - 2. Cut: Match Architect's sample.
- J. Wood Moisture Content: 8 to 13 percent.

2.04 WOOD MATERIALS

- A. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of the Architectural Woodwork Standards for each type of ornamental woodwork and quality grade specified unless otherwise indicated.
- B. Hardwood Lumber:
 - 1. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
 - 2. Wood Moisture Content: 8 to 13 percent.
 - 3. Provide split species on trim that faces areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.
 - 4. For trim items wider than available lumber, use hardwood lumber core, glued for width.
- C. Interior Architectural Woodwork: Refer to Section 064023 - Interior Architectural Woodwork for interior architectural woodwork installed as part of interior ornamental work
- D. Wood-Veneer-Faced Architectural Cabinets: Refer to Section 064113 - Wood-Veneer-Faced Architectural Cabinets for wood cabinets installed as part of interior ornamental work.
- E. Plastic-Laminate-Clad Countertops: Refer to Section 123600 - Countertops for plastic-laminate-clad countertops installed as part of ornamental woodwork.

2.05 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
 - 1. Use stainless steel or fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329/F2329M unless otherwise indicated.
- B. Nails: ASTM F1667.
- C. Power-Driven Fasteners: ICC-ES AC70.
- D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.
- E. Carbon-Steel Bolts: ASTM A307 with ASTM A563 hex nuts and, where indicated, flat washers all hot-dip zinc coated.

- F. Postinstalled Anchors: Stainless-steel, torque-controlled expansion anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E488/E488M conducted by a qualified independent testing and inspecting agency.
 - 1. Stainless-steel bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.06 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, Hanging Strips, and Nailers: Softwood or hardwood 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. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.
- D. Casters for Movable Ornamental Woodwork Items: 3 inch diameter wheels with self-lubricating bearings, rated to carry 365 pounds minimum each. Each caster shall swivel and have a locking brake.
- E. Bullet Resistant Panels: Refer to Section 102641 "Bullet Resistant Panels" for bullet resistant panels installed as part of ornamental woodwork.
 - 1. Refer to Section 012300 - Alternates for alternates affecting this section.
- F. Plastic-Laminate-Clad Countertops: Refer to Section 123600 - Countertops for plastic-laminate-clad countertops installed as part of ornamental woodwork.

2.07 FABRICATION

- A. Fabricate ornamental woodwork to dimensions, profiles, and details indicated.
 - 1. Ease edges to radius indicated for the following:
 - a. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
 - b. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- B. Complete fabrication, including assembly and finishing, to maximum extent possible before shipment to Project site.
 - 1. Disassemble components only as necessary for shipment and installation.
 - 2. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 3. Notify Architect seven days in advance of the dates and times ornamental woodwork fabrication will be complete.
 - 4. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
 - a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
 - b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.
- C. 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.

2.08 SHOP FINISHING

- A. Finish ornamental woodwork 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 cabinets, as applicable to each unit of work.
 - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces.
 - 2. Gluing of face veneers shall, where possible, be by the hot plate method; glued surfaces shall be in close contact throughout. Glue stains will not be permitted.
 - 3. Grain of all transparent finished wood shall run in the direction shown, or if not shown, as accepted on the shop drawings.
- C. Transparent Finish for Interior Items:
 - 1. Architectural Woodwork Standards Grade: Premium.
 - 2. Finish: System - 2, Lacquer, Pre Catalyzed.
 - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - 4. Staining: Match approved sample for color.
 - 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - 6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter according to ASTM D523.

PART 3 EXECUTION

3.01 PREPARATION

- A. Before installation, condition ornamental woodwork to average prevailing humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing ornamental woodwork, examine shop-fabricated work for completion, and complete work as required, including removing packing and backpriming concealed surfaces.

3.02 INSTALLATION

- A. Grade: Install ornamental woodwork to comply with same grade as item to be installed.
- B. Assemble ornamental woodwork, and complete fabrication at Project site to the extent that it was not completed during shop fabrication.
- C. Install ornamental woodwork level, plumb, true in line, and without distortion.
 - 1. Shim as required with concealed shims.
 - 2. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut ornamental woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor ornamental woodwork to anchors or blocking built in or directly attached to substrates.
 - 1. Secure with countersunk, concealed fasteners and blind nailing.
 - 2. Use fine finishing nails for exposed fastening, countersunk and filled flush with ornamental woodwork.
 - 3. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.
 - 4. For shop-finished items, use filler matching finish of items being installed.
- F. Interior Architectural Woodwork: Refer to Section 064023 - Interior Architectural Woodwork for interior architectural woodwork installed as part of interior ornamental work
- G. Wood-Veneer-Faced Architectural Cabinets: Refer to Section 064113 - Wood-Veneer-Faced Architectural Cabinets for wood cabinets installed as part of interior ornamental work.
- H. Bullet Resistant Panels: Refer to Section 102641 - Bullet Resistant Panels for bullet resistant panels installed as part of ornamental woodwork.
- I. Plastic-Laminate-Clad Countertops: Refer to Section 123600 - Countertops for plastic-laminate-clad countertops installed as part of ornamental woodwork.

3.03 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 - 1. Inspection entity shall prepare and submit report of inspection.

3.04 REPAIR

- A. Repair damaged and defective ornamental woodwork, where possible, to eliminate functional and visual defects and to result in interior ornamental woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.
- B. Where not possible to repair, replace defective Work.
- C. Shop Finish: Touch up finishing work specified in this Section after installation of ornamental woodwork.
 - 1. Fill nail holes with matching filler where exposed.
 - 2. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

END OF SECTION 064400

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**SECTION 066100
CAST POLYMER FABRICATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cast resin fabrications.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data for fabricated units.
- C. Shop Drawings:
 - 1. Plans and Elevations: Include dimensions and unit serial numbers; indicate location of fabricated units.
 - 2. Details: Include fabrication shapes and dimensions, thicknesses, fastenings, and anchorages.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in original packages, containers, or bundles bearing brand name and identification.
- B. Store products under cover, elevated above grade, and in dry, well-ventilated areas not exposed to heat or sunlight. Protect from moisture damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cast Resin Assemblies:
 - 1. Basis of Design: 3Form: www.3-form.com/#sle.

2.02 CAST RESIN ASSEMBLIES

- A. Co-Polymer Resin: Plastic fabrications formed into various profiles to simulate stone using resins, fillers, and additives in open-mold processes.
- B. Resin: Polyester.
- C. Color: As indicated on drawings.
- D. Frame: Manufacturer's standard from specified assembly.
- E. Fabrication Tolerances:
 - 1. Maximum Variation from Dimension Height: 1/4 inch in 10 feet.

2.03 FABRICATION

- A. Fabricate units with embedded anchors, stiffening ribs, and sufficient strength for handling and placement stresses.
- B. Fill seams and mold lines; grind smooth and finish to match adjacent cast polymer surfaces.

2.04 ACCESSORIES

- A. General: Accessories recommended by cast resin manufacturer for complete installation.
- B. Fasteners: Threaded fasteners as recommended by cast resin manufacturer; type and size to suit application:
- C. Connectors: As recommended by cast polymer manufacturer; type and size to suit application:

PART 3 EXECUTION

3.01 PREPARATION

- A. Prepare substrates in accordance with manufacturer's written instructions.

3.02 INSTALLATION

- A. Install cast resin assembly in accordance with manufacturer's written instructions.

3.03 TOLERANCES

- A. Maximum Variation from True Position: 1/4 inch.
- B. Maximum Variation from Plumb: 1/4 inch in 10 feet.
- C. Maximum Variation from Level: 1/4 inch in 10 feet.

3.04 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Clean exposed surfaces of installed units in accordance with manufacturer's instructions.

3.05 PROTECTION

- A. Protect installed cast polymer units from subsequent construction operations.

END OF SECTION 066100

**SECTION 068316
FIBERGLASS REINFORCED PANELING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.
- B. Trim.

1.02 REFERENCE STANDARDS

- A. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- B. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns, finish textures, and colors available; and installation instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
 - 1. Crane Composites, Inc: www.cranecomposites.com/#sle.
 - 2. Marlite, Inc: www.marlite.com/#sle.
 - 3. Panolam Industries International, Inc: www.panolam.com/#sle.

2.02 PANEL SYSTEMS

- A. Wall Panels:
 - 1. Panel Size: 4 by 8 feet.
 - 2. Panel Thickness: 0.10 inch.
 - 3. Surface Design: As selected by Architect.
 - 4. Color: White.
 - 5. Attachment Method: As recommended in writing by manufacturer..

2.03 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
 - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION 068316

**SECTION 070150.19
PREPARATION FOR RE-ROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Replacement of existing roofing system in preparation for entire new roofing system.
- B. Removal of existing flashing and counterflashings.
- C. Temporary roofing protection.

1.02 RELATED REQUIREMENTS

- A. Section 075400 - Thermoplastic Membrane Roofing.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with affected mechanical and electrical work associated with roof penetrations.
- B. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Meeting Agenda: Provide agenda to participants prior to meeting in preparation for discussions on the following:
 - a. Removal and installation schedule.
 - b. Necessary preparatory work.
 - c. Protection before, during, and after roofing system installation.
 - d. Removal of existing roofing system.
 - e. Installation of new roofing system.
 - f. Temporary roofing and daily terminations.
- C. Schedule work to coincide with commencement of installation of new roofing system.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate size, configuration, and installation details.

1.05 QUALITY ASSURANCE

- A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least three years of documented experience.
 - 1. Comply with removal and disposal regulations of local authorities having jurisdiction (AHJ).

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.07 FIELD CONDITIONS

- A. Existing Roofing System: Built-up asphalt roofing.
- B. Verify that work by Owner affecting re-roofing has been completed.
- C. Do not remove existing roofing membrane when weather conditions threaten the integrity of building contents or intended continued occupancy.
- D. Verify that occupants have been evacuated from building areas when work on structurally impaired roof decking is scheduled to begin.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 COMPONENTS

- A. See the following sections for additional information on components relating to this work:
 - 1. Replacement and removal of existing roofing system in preparation for entire new roofing system, see Section 075100.

2.02 MATERIALS

- A. Temporary Roofing Protection Materials:
 - 1. Contractor's responsibility to select appropriate materials for temporary protection of roofing areas as determined necessary for this work.

2.03 ACCESSORIES

- A. Fasteners: Type and size as required and compatible with existing and new roofing system to resist local wind uplift.
- B. Roof Vent Pipe Extension: Solid-wall PVC fitting consisting of pipe and splice sleeve inserts, configured for insertion and sealing to existing plumbing vent piping, sized to fit inside diameter of plumbing vent piping, enabling extension of piping to field-determined height to meet local building code requirements for plumbing vent pipe height above existing roof level.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing roof surface has been cleared of materials being removed from existing roofing system and ready for next phase of work as required.

3.02 PREPARATION

- A. Sweep roof surface clean of loose matter.
- B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

- A. Remove only existing roofing materials that can be replaced with new materials as the weather will permit.
 - 1. If hazardous material is encountered, stop work and promptly notify Owner and Architect.
- B. Remove metal counter flashings.
- C. Repair existing deck surface to provide smooth working surface for new roof system.

3.04 INSTALLATION

- A. Coordinate scope of this work with requirements for installation of new roofing system, see Section 075100 for additional requirements.

3.05 FIELD QUALITY CONTROL

- A. Independent agency inspection and testing will be provided under provisions of Section 014000.

3.06 PROTECTION

- A. Provide temporary protective sheeting over uncovered deck surfaces.
- B. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.
- C. Provide for surface drainage from sheeting to existing drainage facilities.
- D. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION 070150.19

**SECTION 070553
FIRE AND SMOKE ASSEMBLY IDENTIFICATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.
- C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

1.05 FIELD CONDITIONS

- A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.
- B. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS

2.01 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

- A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).
- B. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 099123 for products.

2.02 WALL IDENTIFICATION

- A. Wall Identification: Permanently label fire barriers, fire partitions, fire walls, smoke barriers, and smoke partitions 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 (9.5-mm) 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 .
 - 2. Apply a minimum of one-inch-wide bright red horizontal line, both sides of wall, interrupted for approved text at the required interval.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 PREPARATION

- A. See Section 099123 for substrate preparation for painted markings.

3.03 INSTALLATION

- A. Locate markings as required by ICC (IBC).
- B. Install applied markings in accordance with Section 099123.

- C. Install neatly, with horizontal edges level.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION 070553

**SECTION 071113
BITUMINOUS DAMPPROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Bituminous dampproofing.
- B. Protection boards.
- C. Drainage panels.

1.02 REFERENCE STANDARDS

- A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing 2011 (Reapproved 2016).
- B. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal 1997 (Reapproved 2018).
- C. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing 2013, with Editorial Revision (2019).
- D. NRCA (WM) - The NRCA Waterproofing Manual 2021.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.

1.04 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bituminous Dampproofing Manufacturers:
 - 1. Karnak Corporation: www.karnakcorp.com/#sle.
 - 2. Mar-flex Waterproofing & Building Products: www.mar-flex.com/#sle.
 - 3. W. R. Meadows, Inc: www.wrmeadows.com/#sle.

2.02 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
 - 1. Asphalt-Base Emulsion for Metal Protective Coating: ASTM D1187/D1187M, Type I - Continuous water exposure within few days after drying or Type II - Continuous weather exposure after drying.
 - 2. Emulsified Asphalt for Roofing Protective Coating: ASTM D1227/D1227M, Type II, Class 1 - Mineral colloid emulsifying agents with non-asbestos fibers.
 - 3. VOC Content: Not more than permitted by local, State, and federal regulations.
 - 4. Applied Thickness: 1/16 inch, minimum, wet film.

2.03 BITUMEN MATERIALS

- A. Cold Asphaltic Type:
 - 1. Emulsified Asphalt: ASTM D1227/D1227M, with fiber reinforcement other than asbestos, Type II, Class 1 or 2.
 - 2. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

2.04 ACCESSORIES

- A. Drainage Panel: 1/4-inch thick formed plastic, hollowed sandwich.

- B. Protection Board: Type recommended by waterproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

- A. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- C. Apply bitumen according to manufacturer's written instructions.
- D. Apply from 2 inches below finish grade elevation down to top of footings.
- E. Seal items watertight with mastic, that project through dampproofing surface.
- F. Place drainage panel directly over dampproofing, butt joints, and position to ensure downward drainage.
 - 1. Extend filter fabric over exposed drain core of drainage mats.
- G. Place protection board over drainage panel, butt joints, and adhere with mastic.
- H. Scribe and cut boards around projections, penetrations, and interruptions.
- I. Back-fill with properly compacted soil as early as possible after waterproofing/dampproofing and drainage mat are installed.

END OF SECTION 071113

**SECTION 071300
SHEET WATERPROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Composite sheet membrane applied prior to rebar and concrete placement.
- B. Self-adhered modified bituminous sheet membrane.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete substrate.
- B. Section 072100 - Thermal Insulation: Insulation used for protective cover.

1.03 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-- Tension 2016 (Reapproved 2021).
- B. ASTM D570 - Standard Test Method for Water Absorption of Plastics 2022.
- C. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting 2018.
- D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds 1998 (Reapproved 2017).
- E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- F. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems 2018.
- G. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes 2020.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- I. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover 2008a (Reapproved 2019).
- J. NRCA (WM) - The NRCA Waterproofing Manual 2021.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for membrane.
- C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

1.05 FIELD CONDITIONS

- A. Install only when ambient temperatures are within range as recommended in writing by membrane manufacturer.
- B. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Contractor to correct defective Work within period of five years after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
- C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 SHEET WATERPROOFING MATERIALS

- A. Composite Sheet Membrane Applied Prior to Rebar and Concrete Placement:
1. Type: Elastomeric composite sheet membrane bonded to seven-ply matrix and non-woven geotextile fabric.
 2. Thickness: 73 mil, nominal.
 3. Sheet Width: 39-3/8 inches, minimum.
 4. Elongation: 400 percent, minimum, measured in accordance with ASTM D412.
 5. Water Vapor Permeance: .0011 perm, maximum, measured in accordance with ASTM E96/E96M, Method B.
 6. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F.
 7. Peel Adhesion to Concrete: 10 lb/inch, minimum, when tested in accordance with ASTM D903.
 8. Puncture Resistance: 210 lb, minimum, measured in accordance with ASTM E154/E154M.
 9. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 230 feet head of water applied in accordance with test method ASTM D5385/D5385M.
 10. Tensile Strength (Film): 9n200 psi, nominal, ASTM D882.
 11. Crack Cycling: Passes when tested in accordance with ASTM C836/C836M.
 12. Pesticide Penetration Resistance: 0.0 percent, when measured in accordance with ASTM F2130.
 13. Adhesives, Sealants, Tapes, and Accessories: As recommended in writing by membrane manufacturer.
 14. Products:
 - a. Basis of Design: W.R. Meadows PreCpon Pre-Applied / Underslab / Blindside Waterproofing Membrane.
 - b. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861: www.carlisleccw.com/#sle.
 - c. CETCO, a division of Minerals Technologies Inc: www.mineralstech.com/#sle.
 - d. GCP Applied Technologies: www.gcpat.com/#sle
 - e. Henry Company: www.henry.com/#sle.
 - f. Sika USA; <https://usa.sika.com/>
- B. Self-Adhered Modified Bituminous Sheet Membrane:
1. Thickness: 60 mil, 0.060 inch, minimum.
 2. Sheet Width: 36 inches, minimum.
 3. Tensile Strength:
 - a. Film: 5,000 psi, minimum, measured in accordance with ASTM D882 and at grip-separation rate of 2 inches per minute.
 - b. Membrane: 400 psi, minimum, measured in accordance with ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
 4. Elongation at Break: 900 percent, minimum, measured in accordance with ASTM D412.
 5. Water Vapor Permeance: 0.02 perm, maximum, measured in accordance with ASTM E96/E96M.
 6. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
 7. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
 8. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 200 feet head of water applied in accordance with test method ASTM D5385/D5385M.
 9. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.

10. Products:
 - a. Basis of Design: W.R. Meadows, Inc; MEL-ROL: www.wrmeadows.com/#sle.
 - b. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861: www.carlisleccw.com/#sle.
 - c. CETCO, a division of Minerals Technologies Inc; ENVIROSHEET:
www.mineralstech.com/#sle.
 - d. GCP Applied Technologies: www.gcpat.com/#sle.
 - e. Henry Company; Blueskin WP 200: www.henry.com/#sle.

2.02 ACCESSORIES

- A. Surface Conditioner: As recommended in writing by membrane manufacturer.
- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- C. Protection Board: Rigid insulation; see Section 072100.
- D. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
 1. Composition: Dimpled polystyrene, polyethylene, or polypropylene core; polypropylene filter fabric.
 2. Thickness: As indicated on drawings.
 3. Provide product approved in writing by sheet waterproofing manufacturer.
- E. Flexible Flashings: Type recommended by membrane manufacturer.
- F. Termination Bars: Aluminum; compatible with membrane and adhesives.
- G. Adhesives: As recommended by membrane manufacturer.
- H. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify that items penetrating surfaces to receive waterproofing are securely installed.
- D. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
- E. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
- C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
- D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.
- E. Seal moving cracks with sealant and nonrigid filler, using procedures recommended by sealant and waterproofing manufacturers.
- F. Prepare building expansion joints at locations as indicated on drawings.
- G. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.
- H. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate in accordance with ASTM D5295/D5295M.
 1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.

2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, ruttled cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in reference standard.
3. Remove and replace areas of defective concrete; see Section 033000.
4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in referenced standard.
5. Test concrete surfaces as described in referenced standards, and verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.03 INSTALLATION - MEMBRANE

- A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Roll out membrane, and minimize wrinkles and bubbles.
- C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
 1. Roll entire surface of waterproofing membrane.
- D. Overlap edges and ends as outlined below. Seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
 1. Side laps; 3 inches, minimum
 2. End laps: 6 inches minimum
 3. Staggered seam: 12 inches minimum.
- E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
 1. Install termination bar and sealant along top edge of membrane.
- F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
- G. Install building expansion joints at locations as indicated on drawings.
- H. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- I. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

- A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward; scribe and cut boards around projections, penetrations, and interruptions.
- B. Place protection board directly against drainage panel; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.
 1. Extend filter fabric over exposed drain core of drainage mats.
- C. Adhere protection board to substrate with compatible adhesive.
- D. Back-fill with properly compacted soil as early as possible after waterproofing/damproofing and drainage mat are installed

3.05 PROTECTION

- A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION 071300

SECTION 071900 WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water repellents applied to exterior masonry surfaces.

1.02 RELATED REQUIREMENTS

- A. Section 042000 - Unit Masonry: Brick to be coated
- B. Section 047200 - Cast Stone Masonry: Cast stone masonry to be coated.

1.03 REFERENCE STANDARDS

- A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units 2022c.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.

1.05 FIELD CONDITIONS

- A. Protect liquid materials from freezing.
- B. Do not apply water repellent when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.
- C. Do not apply water repellents when wind velocity is higher than as recommended in writing by manufacturer..

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Siloxane Water Repellents:
 - 1. BASF Construction Chemicals: www.buildingsystems.basf.com/#sle.
 - 2. Dayton Superior Corporation: www.daytonsuperior.com/#sle.
 - 3. Pecora Corporation: www.pecora.com/#sle.

2.02 MATERIALS

- A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
 - 1. Applications: Vertical surfaces and non-traffic horizontal surfaces.
 - 2. Number of Coats: As recommended in writing by manufacturer.
 - 3. Moisture Absorption When Applied to Masonry: Five percent, maximum, when tested in accordance with ASTM C140/C140M using masonry sample completely coated with water repellent.
 - 4. Maintains dry appearance when wetted.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify joint sealants are installed and cured.

- C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

- A. Protection of Adjacent Work:
 - 1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
 - 2. Protect adjacent surfaces not intended to receive water repellent.
- B. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.
- C. Do not start work until masonry mortar substrate is cured a minimum of 60 days.
- D. Remove loose particles and foreign matter.
- E. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.
- F. Scrub and rinse surfaces with water and let dry.
- G. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work.

3.03 APPLICATION

- A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
- B. Apply at rate recommended by manufacturer, continuously over entire surface.
- C. Apply two coats, minimum.
- D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION 071900

SECTION 072100 THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall and exterior wall.
- B. Batt insulation in interior and exterior wall and ceiling construction.
- C. Radiant barrier insulation.

1.02 RELATED REQUIREMENTS

- A. Section 075400 - Thermoplastic Membrane Roofing: Installation requirements for board insulation over low slope roof deck.

1.03 DEFINITIONS

- A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.
 - 1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
 - 2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
 - 3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.04 REFERENCE STANDARDS

- A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2022.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- E. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board 2017.
- F. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation 2023.
- G. ASTM C1313/C1313M - Standard Specification for Sheet Radiant Barriers for Building Construction Applications 2013 (Reapproved 2019).
- H. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings 2019 (Reapproved 2022).
- I. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- L. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.

- M. ICC-ES AC220 - Acceptance Criteria for Sheet Radiant Barriers 2010, with Editorial Revision (2013).
- N. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.06 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
 - 5. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.

2.02 MINERAL FIBER BOARD INSULATION MATERIALS

- A. Mineral Wool Roof Insulation Boards: Complying with ASTM C726, with higher density top layer.
 - 1. Face Coating: None, unfaced.
 - 2. Board Size: 48 by 48 inches.
 - 3. Board Thickness: 2 inches.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
 - 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
- B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
 - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
 - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 - 3. Thickness: As indicated on Drawings and as required to achieve assembly STC rating but not less than 3 inches.
 - 4. Products:
 - a. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.
 - b. ROCKWOOL; AFB: www.rockwool.com/#sle.
 - c. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.

2.04 RADIANT BARRIER INSULATION MATERIALS

- A. Radiant Barrier and Insulation Facing: Aluminum foil facing bonded to natural kraft paper and reinforced with multi-directional fiberglass scrim in accordance with ICC-ES AC220 and ASTM C1313/C1313M.
 - 1. Application: Apply as indicated on drawings.
 - 2. Water Vapor Permeance: 0.020 perm, when tested in accordance with ASTM E96/E96M.
 - 3. Tensile Strength: In accordance with ASTM C1136.
 - a. Machine Direction: 40 lb per 1 inch width.
 - b. Cross Direction: 25 lb per 1 inch width.
 - 4. Surface Burning Characteristics: Smoke developed index of 450 or less, and flame spread index of 25 or less, Class A, when tested in accordance with ASTM E84.
 - 5. Temperature Resistance: No cracking or delamination within temperature range of minus 40 degrees F to 240 degrees F in accordance with ASTM D1970/D1970M.
 - 6. Mold and Mildew Resistance: Zero growth when tested in accordance with ASTM C1338.
 - 7. Tabs, Strips, Seam and Perimeter Tape: As recommended by sheet manufacturer.
 - 8. Products:
 - a. Fi-Foil Company, Inc; FSK Shield Class A Insulation Facing/Vapor Retarder:
www.fifoil.com/#sle.

2.05 ACCESSORIES

- A. Interior Vapor Retarder: Modified polyethylene/polyacrylate (PE/PA) film reinforced with polyethylene terephthalate (PET) fibers, 12 mil, 0.012 inch thick.
 - 1. Width: 4.9 feet.
- B. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
 - 1. Application: Sealing of interior circular penetrations, such as pipes or cables.
 - 2. Width: Are required for application.
 - 3. Temperature Resistance: Range of minus 40 to 212 degrees F.
- C. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- D. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- E. Protection Board for Below Grade Insulation: Cementitious, 1/4 inch thick.
- F. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Install boards horizontally on foundation perimeter.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and to protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
 - 1. Back-fill with properly compacted soil as early as possible after insulation and protection boards are installed

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

- A. Install boards horizontally on walls.
 - 1. Place boards to maximize adhesive contact.
 - 2. Install in running bond pattern.
 - 3. Butt edges and ends tightly to adjacent boards and protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
 - 1. Stick-pins adhered to weather resistive barrier may be necessary to secure insulation boards.
- C. Tape insulation board joints.

3.04 BATT INSTALLATION

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- F. At metal framing, place vapor retarder as indicated on Drawings; lap and seal sheet retarder joints over face of member
- G. Tape seal tears or cuts in vapor retarder.
- H. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane; tape seal in place.

3.05 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION 072100

**SECTION 072119
FOAMED-IN-PLACE INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Foamed-in-place insulation (spray foam insulation).
- B. Protective intumescent coating at exposed insulation and where insulation is indicated as being behind radiant barrier and insulation facing.

1.02 RELATED REQUIREMENTS

- A. Section 012300 - Alternates: For alternates affecting products specified in this section.
- B. Section 072100 - Thermal Insulation: Other forms of insulation.

1.03 REFERENCE STANDARDS

- A. AC377 - Spray-applied Foam Plastic Insulation 2020.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- C. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation 2020.
- D. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- G. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.
- H. FM 4880 - Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials 2017.
- I. NFPA 275 - Standard Method of Fire Tests for the Evaluation of Thermal Barriers 2022.
- J. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2019.
- K. UL 1040 - Standard for Safety Fire Test of Insulated Wall Construction Current Edition, Including All Revisions.
- L. UL 1715 - Standard for Safety Fire Test of Interior Finish Material Current Edition, Including All Revisions.
- M. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.05 SUBMITTALS

- A. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- B. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified, with minimum ten years of experience, and approved by manufacturer.

1.07 FIELD CONDITIONS

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Foamed-In-Place Insulation:
 - 1. BASF Corporation: www.spf.basf.com/#sle.
 - 2. Carlisle Spray Foam Insulation: www.carlisesfi.com/#sle.
 - 3. Demilec Inc.: www.demilec.com/#sle.
 - 4. Gaco Western: www.gaco.com/#sle.
 - 5. Henry Company: www.henry.com/#sle.
 - 6. Icynene-Lapolla: www.icynene.com/#sle.
 - 7. Johns Manville: www.jm.com/#sle.
 - a. Refer to Basis of Design product below.

2.02 MATERIALS

- A. Foamed-In-Place Insulation: ASTM C1029, Type II, medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
 - 1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and fire protection requirements.
 - a. Fire Protection: Provide 15-minute thermal barrier where required, complying with NFPA 275 test method, or foamed-in-place insulation either exposed or with covering that complies with FM 4880, NFPA 286, UL 1040, or UL 1715.
 - b. Fire Protection: Provide 15-minute thermal barrier of 1/2 inch gypsum board or equivalent material complying with NFPA 275 test method, or foamed-in-place insulation either exposed or with covering that complies with FM 4880, NFPA 286, UL 1040, or UL 1715.
 - 2. Thermal Resistance: R-value of 6.6, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
 - 3. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
 - 4. Water Absorption: Less than 1 percent by volume, maximum, when tested in accordance with ASTM D2842.
 - 5. Air Permeance: 0.04 cfm per square foot, maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.
 - 6. Closed Cell Content: At least 90 percent.
 - 7. Surface Burning Characteristics: Flame spread/Smoke developed index of 75/450, maximum, when tested in accordance with ASTM E84.
 - 8. Fire Propagation Characteristics: Passes NFPA 285 as part of an approved assembly.
 - 9. Manufacturers:
 - a. BASF Corporation: www.spf.basf.com/#sle.
 - b. Carlisle Spray Foam Insulation: www.carlisesfi.com/#sle.
 - c. Gaco Western: www.gaco.com/#sle.
 - d. Henry Company: www.henry.com/#sle.
 - e. Icynene-Lapolla: www.icynene.com/#sle.
 - f. Johns Manville: www.jm.com/#sle.

2.03 ACCESSORIES

- A. Primer: As required by insulation manufacturer.

- B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.
 - 1. Coating Type: Single component, water-based.
 - 2. Thermal Barrier: Material barrier intended to prevent flame-source access to foam and delay temperature-rise of foam during a fire event.
 - a. Materials tested in accordance with and complying with acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.
 - b. Thermal Barrier Coating: Fire-protective intumescent coating formulated for application over polyurethane foam plastics, compatible with insulation, and passes NFPA 275 testing as part of an approved assembly.
 - c. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - d. Topcoat: 8- to 12-mil- thick, water-based latex-based paint recommended in writing by intumescent thermal barrier manufacturer as compatible with substrate materials.
 - 3. Ignition Barrier: Material providing a 15-minute minimum fire-ignition barrier.
 - a. Ignition Barrier Coating: Fire-protective coating formulated for application over polyurethane foam plastics, compatible with insulation, and in compliance with AC377.
 - b. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 4. Protected Insulation Type: Spray polyurethane foam (SPF).
 - 5. Application: Apply using brush, roller, or airless sprayer.
 - 6. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
 - 7. Color: As indicated on drawings.
 - 8. Install at the underside of exposed insulation including concrete podium roof deck foamed-in-place insulation and at occupied attic locations.
 - 9. Product compatible with and recommended in writing by foamed-in place insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Apply to thickness required to achieve a thermal resistance R-value as indicated on the drawings.
- D. Patch damaged areas.
- E. Apply insulation in voids and gaps on the exterior skin of the building to ensure complete thermal envelope integrity.
 - 1. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

- F. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 PROTECTION

- A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION 072119

**SECTION 072423
DIRECT APPLIED FINISH SYSTEM (DEFS)**

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. Direct-applied exterior finish system that are field applied over substrate.

1.02 RELATED REQUIREMENTS:

- A. Section 061600 "Sheathing" for substrate.

1.03 REFERENCE STANDARDS

- A. ASTM 2098/E2098M - Standard Test Method for Determining Tensile Breaking Strength of Glass Fiber Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to a Sodium Hydroxide Solution 2013, Revised 2018.
- B. ASTM C150/C150M - Standard Specification for Portland Cement 2022.
- C. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster 2022a.
- D. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage 2013 (Reapproved 2019).
- E. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive 2022.
- F. ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds 2020.
- G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- H. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation 2021.
- I. ASTM E2511 - Standard Guide for Detailing of EIFS-Clad Barrier and Drainage Wall Assemblies 2017, Revised 2023.
- J. ASTM E2568 - Standard Specification for PB Exterior Insulation and Finish Systems 2017.

1.04 SUBMITTALS

- A. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.
- B. Shop Drawings: Indicate wall and soffit joint patterns, joint details, edge details, corner details, and all connection details.
 - 1. Provide shop drawings specific to Project.
- C. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches square, illustrating project colors and textures.
- D. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.
- E. Installer's qualification statement.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Trained and certified by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.

- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.

1.07 FIELD CONDITIONS

- A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.
- B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.
- C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.
- D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

1.08 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of DEFS that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Bond integrity and weathertightness.
 - b. Deterioration of DEFS finishes and other DEFS materials beyond normal weathering.
 - 2. Warranty coverage includes the following DEFS components:
 - a. DEFS finish, including base coats, finish coats, and reinforcing mesh.
 - b. DEFS accessories, including trim components and flashing.
 - 3. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide [Sto Corp](#); StoQuik Gold Soffit or a comparable system by one of the following:
 - 1. [BASF Corporation; Wall Systems](#).
 - 2. [Dryvit Systems, Inc.](#)
 - 3. [Finestone; BASF Corp.](#)
 - 4. [Parex USA, Inc.](#)
- B. Source Limitations: Obtain DEFS from single source from single DEFS manufacturer and from sources approved by DEFS manufacturer as tested and compatible with DEFS components.

2.02 PERFORMANCE REQUIREMENTS

- A. DEFS Performance: Comply with ASTM E2568 and with the following:
 - 1. Weathertightness: Resistant to water penetration from exterior.
 - 2. Structural Performance of Assembly and Components:
 - a. Wind Loads: Uniform pressure as indicated on Drawings.
 - 3. Impact Performance: ASTM E2568 , Standard impact resistance.
 - 4. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch- thick DEFS mounted on 1/2-inch- thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested according to ASTM D968, Method A.
 - 5. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D3273 and evaluated according to ASTM D3274.

2.03 DEFS MATERIALS

- A. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; DEFS manufacturer's standard or product recommended in writing by DEFS manufacturer.
 - a. Verify in writing compatibility with fluid-applied membrane air barrier.

- B. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other DEFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. according to ASTM 2098/E2098M and the following:
 - 1. Reinforcing Mesh for DEFS, General: Not less than weight required to comply with impact-performance level specified above.
 - 2. Strip-Reinforcing Mesh: Not less than 3.75 oz./sq. yd.
- C. Base Coat: DEFS manufacturer's standard mixture complying with[one of] the following:
 - 1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
 - 2. Job-combined formulation of manufacturer's standard polymer-emulsion adhesive and manufacturer's standard dry mix containing portland cement.
 - 3. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
 - 4. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.
- D. Primer: DEFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- E. Finish Coat: DEFS manufacturer's standard acrylic-based coating with enhanced mildew resistance complying with the following:
 - 1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 - 2. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, and fillers used with stone particles for embedding in finish coat to produce an applied-aggregate finish.
 - 3. Colors: As selected by Architect from manufacturer's full range, in consultation with Owner.
 - 4. Textures: As selected by Architect from manufacturer's full range, in consultation with Owner.
- F. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
- G. Water: Potable.
- H. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with DEFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784 and ASTM C1063.
 - 1. Expansion Joint: Closed-cell polyethylene backer rod and elastomeric sealant, 3/4-inch minimum.

2.04 MIXING

- A. Comply with manufacturer's written requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended in writing by manufacturer. Mix materials in clean containers. Use materials within time period specified by manufacturer or discard.

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. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Begin coating application only after surfaces are dry.
 - 2. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of DEFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect DEFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind DEFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with DEFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.
 - 1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by DEFS manufacturer.

3.03 DEFS INSTALLATION, GENERAL

- A. Comply with ASTM C1397, ASTM E2511, and DEFS manufacturer's written instructions for installation of DEFS as applicable to each type of substrate.

3.04 SUBSTRATE PROTECTION APPLICATION

- A. Flexible-Membrane Flashing: Apply and lap to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.05 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of DEFS, at expansion joints, and elsewhere as indicated. Coordinate with installation of insulation.
 - 1. Expansion Joint: Use where indicated on Drawings.

3.06 BASE-COAT APPLICATION

- A. Base Coat: Apply full coverage to exposed insulation with not less than 1/8-inch dry-coat thickness.
- B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches (200 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- C. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.
- D. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch-wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.
 - 1. At aesthetic reveals, apply strip-reinforcing mesh not less than 8 inches (200 mm) wide.
 - 2. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.
- E. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.07 FINISH-COAT APPLICATION

- A. Primer: Apply over dry base coat.
- B. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample.
- C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by DEFS manufacturer.

3.08 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive DEFS coatings.

END OF SECTION 072423

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**SECTION 072500
WEATHER BARRIERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Weather-resistant air barriers.

1.02 REFERENCE STANDARDS

- A. AAMA 714 - Voluntary Specification for Liquid Applied Flashing Used to Create a Water-Resistive Seal around Exterior Wall Openings in Buildings 2019.
- B. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure 2018, with Editorial Revision (2019).
- C. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions 2016.
- D. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).
- E. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings 2017 (Reapproved 2021).
- F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- G. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).
- H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- I. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers 2022.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- K. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- L. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- M. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.
- N. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies 2018.
- O. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing 2015, with Editorial Revision (2020).
- P. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
 - 1. Include ICC evaluation reports as applicable.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

1.05 MOCK-UPS

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Construct weather barrier mock-up as part of exterior assembly mockup as directed.
- C. Locate where directed.
- D. Mock-up may remain as part of work.

1.06 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.01 WATER-RESISTIVE BARRIER MATERIALS

- A. Water-Resistive Barrier: For use in Construction Types I, II, III, and IV on buildings greater than 40 feet in height.
 - 1. Comply with NFPA 285 wall assembly requirements in accordance with local building code and authorities having jurisdiction (AHJ).
 - 2. Source Limitations: Obtain primary weather barrier materials and weather barrier accessories from single source from single manufacturer.
- B. Water-Resistive Barrier Coating: Fluid applied, UV-resistant coating for use over various types of exterior sheathing, CMU, and precast concrete in accordance with ICC-ES AC212.
 - 1. Material: Water based latex.
 - 2. Dry Film Thickness (DFT): As recommended in writing by manufacturer for substrate.
 - 3. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
 - 4. Fire Resistance: Permitted for use in exterior walls of fire-resistance-rated construction assemblies, ASTM E119.
 - 5. Air Permeance: When tested in accordance with ASTM E2178:
 - a. Building Envelope Leakage: 0.4 cfm/sq ft, maximum.
 - b. Material Leakage: 0.004 cfm/sq ft, maximum.
 - 6. Assembly Air Leakage: 0.04 cfm/sq ft, maximum, when tested in accordance with ASTM E2357.
 - 7. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F.
 - 8. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
 - 9. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
 - 10. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
 - 11. Flexibility: No cracking or delamination before and after aging when tested in accordance with ASTM D522/D522M
 - 12. Resistance to Mold: No mold growth after 28 days when tested in accordance with ASTM D3273.
 - 13. Adhesion: Not less than 30 psi, when tested in accordance with ASTM C297/C297M.
 - 14. Field Adhesion Testing: Not less than 30 psi, when tested in accordance with ASTM D4541
 - 15. VOC Content: Zero.
 - 16. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
 - 17. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 6 month of weather exposure.

18. Products:
 - a. GCP Applied Technologies: www.gcpat.com/#sle.
 - b. Henry Company: www.henry.com/#sle.
 - c. Parex USA, Inc: www.parexusa.com/#sle.
 - d. Pecora Corporation: www.pecora.com/#sle.
 - e. PROSOCO, Inc: www.prosoco.com/r-guard/#sle.
 - f. Basis of Design: Sto Corp; Sto Gold Coat: www.stocorp.com/#sle.
 - g. Substitutions: See Section 016000 - Product Requirements.

2.02 ACCESSORIES

- A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with weather barrier manufacturer's written installation instructions.
- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and as recommended in writing weather barrier materials.
 1. Application: Apply at 20 to 30 mil, 0.020 to 0.030 inch nominal thickness.
 2. Elongation: Not less than 420 percent when measured in accordance with ASTM D412.
 3. Comply with NFPA 285 requirements for wall assembly.
 4. Products:
- C. Preformed Transition Membrane: Semi-rigid silicone or polyester composition, tapered edges, and tear resistant.
- D. Foil-faced Self-adhering Membrane: To be applied at locations where sealant to be applied to air barrier, such as wall openings where window frame perimeter sealant is applied to weather resistive barrier.
- E. Liquid Flashing: One part, fast curing, nonsag, elastomeric, gun grade, trowelable liquid flashing, complying with AAMA 714.
 1. Provide product compatible with
 2. Water Penetration Resistance: No water penetration after 5 hours when tested in accordance with AATCC Test Method 127.
 3. Adhesion: Not less than 15 psi when tested in accordance with ASTM D4541.
 4. Durometer Hardness: Minimum of 30 for Type A, after 28 days when tested in accordance with ASTM D2240.
 5. Elongation: Not less than 350 percent when measured in accordance with ASTM D412.
- F. Primer: As recommended in writing by weather barrier manufacturer, where required.
- G. Thinners and Cleaners: As recommended in writing by weather barrier manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
 1. Apply sealant over sheathing fasteners, joints in sheathing, voids in substrate, etc. prior to application of weather resistive barrier/
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

- A. Install materials in accordance with manufacturer's written installation instructions.
 1. Roll entire surface of self-adhering membranes with hand-held roller at time of application

- B. Weather-Resistive Barriers: Install continuous water-resistive barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's written installation instructions.
- D. Apply sealant over sheathing fasteners, joints in sheathing, voids in substrate, etc. prior to application of WRB
- E. Fluid-Applied Coatings or Membranes:
 - 1. Prepare substrate in accordance with manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
 - 2. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.
 - a. Apply termination sealant along edges of self-adhering transition membrane
- F. Openings and Penetrations in Exterior Weather Barriers:
 - 1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 - 2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
 - 3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
 - 4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
 - 5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
 - 6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. During application of fluid-applied weather resistive barrier, check wet film thickness with wet mil gauge, minimum every 100 sf of application, documenting wet mil checks.
- C. Perform random dry film thickness checks, removing 1-inch square of cured membrane and measuring dry film thickness with hand-held comparator.
- D. Do not cover installed weather barriers until required inspections have been completed.

3.05 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 072500

**SECTION 075400
THERMOPLASTIC MEMBRANE ROOFING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mechanically attached system with thermoplastic roofing membrane.
- B. Insulation, flat and tapered.
- C. Vapor retarder.
- D. Cover boards.
- E. Flashings.
- F. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 REFERENCE STANDARDS

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2022a.
- C. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing 2021.
- D. ASTM G154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials 2016.
- E. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials 2021.
- F. NRCA (RM) - The NRCA Roofing Manual 2023.
- G. NRCA (WM) - The NRCA Waterproofing Manual 2021.
- H. UL (FRD) - Fire Resistance Directory Current Edition.
- I. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies Current Edition, Including All Revisions.
- J. UL 1897 - Uplift Tests for Roof-Covering Systems; Underwriters Laboratories Inc. Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
- C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, paver layout, and taper plan.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.
- F. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
- G. Installer's qualification statement.

- H. Specimen Warranty: For approval.
- I. Warranty Documentation:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of this section with at least ten years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

1.07 FIELD CONDITIONS

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or when ambient temperature is above the maximum temperature recommended for installation by roofing membrane manufacture.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
 - 1. Warranty Term: 20 years, "No Dollar Limit."
 - 2. For repair and replacement include costs of both material and labor in warranty.
 - 3. Exceptions are not Permitted:
 - a. Damage due to wind speed greater than 56 miles per hour but less than 90 miles per hour.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
 - 1. Carlisle Roofing Systems, Inc: www.carlisle-syntec.com/#sle.
 - 2. Elevate by Holcim: www.holcimelevate.com/#sle.
 - 3. Flex Membrane International Corporation: www.flexroofingsystems.com/#sle.
 - 4. GAF: www.gaf.com/#sle.
 - 5. Johns Manville: www.jm.com/#sle.
 - 6. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: Supplied or as approved in writing by roof membrane manufacturer.

2.02 ROOFING - UNBALLASTED APPLICATIONS

- A. Thermoplastic Membrane Roofing: One ply membrane, mechanically fastened, over insulation.
 - 1. Source Limitations: Obtain components for roofing system from manufacturers approved in writing by roof membrane manufacturer
- B. Roofing Assembly Requirements:
 - 1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Wind Uplift Resistance: Design roofing system to meet ASCE 7 requirements and to resist the following wind uplift pressures when tested according to UL 580 or UL 1897:
 - a. Indicate dimensions of perimeter and corners in subparagraphs below for simple roof shapes or indicate on Drawings.
 - 1) Zone 1 (Roof Area Field): As indicated on Drawings.
 - 2) Zone 2 (Roof Area Perimeter): As indicated on Drawings.
 - 3) Location: As indicated on Drawings.
 - b. Zone 3 (Roof Area Corners): As indicated on Drawings>.
 - 1) Location: As indicated on Drawings.
 - c. See Drawings for Building Risk Category and Exposure.
 - 3. Roof Covering External Fire Resistance Classification: UL (FRD).
 - 4. Insulation Thermal Resistance (R-Value): 5.5 per inch, minimum; provide insulation of thickness required.
- C. Acceptable Insulation Types: Any of types specified.
 - 1. Minimum 2 layers of polyisocyanurate board.
 - 2. With high density polyisocyanurate cover board in addition to the 2 layers of constant thickness polyisocyanurate board.
- D. Acceptable Insulation Types - Constant Thickness Application: Any of types specified.
 - 1. Minimum 2 layers of polyisocyanurate board.
 - 2. With high density polyisocyanurate cover board in addition to the 2 layers of constant thickness polyisocyanurate board.

2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS

- A. Membrane Roofing Materials:
 - 1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrim.
 - a. Thickness: 80 mil, 0.080 inch, minimum.
 - 2. Color: White.
- B. Seaming Materials: As recommended in writing by membrane manufacturer..
- C. Membrane Fasteners: As recommended and approved by membrane manufacturer.
- D. Vapor Retarder: Material approved by roof manufacturer complying with requirements of fire rating classification; compatible with roofing and insulation materials.
 - 1. Fire-retardant adhesive.
- E. Flexible Flashing Material: Same material as membrane.
- F. Separation Sheet: Sheet polyethylene; 2 mil, 0.002 inch thick.

2.04 COVER BOARDS

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
 - 1. Thickness: 5/8 inch, Type X, fire-resistant.
 - 2. Products: As approved in writing by roof membrane manufacturer.
 - a. Georgia-Pacific; DensDeck: www.densdeck.com/#sle.
 - b. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.
 - c. USG Corporation; Securock: www.usg.com/#sle

2.05 INSULATION

- A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
 - 1. Classifications:
 - a. Type VII: Faced with glass mat faced gypsum board on one major surface of the core foam and faced on the other major surface with any facer described in this specification.
 - 1) Compressive Strength: 16 psi, minimum.
 - 2) Thermal Resistance, R-value: R-30 minimum.
 - 2. Board Size: 48 by 96 inches.
 - 3. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
 - 4. Products: As recommended in writing by roof membrane manufacturer.

2.06 ACCESSORIES

- A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- B. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
 - 1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
- C. Membrane Adhesive: As recommended in writing by membrane manufacturer.
- D. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- E. Thinners and Cleaners: As recommended in writing by adhesive manufacturer, compatible with membrane.
- F. Insulation Adhesive: As recommended in writing by insulation manufacturer.
- G. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils thick, minimum, of same color as TPO sheet.
- H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
- I. Sealants: As recommended in writing by membrane manufacturer.
- J. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
 - 1. Composition: Asphaltic with mineral granule surface or Roofing membrane manufacturer's standard.
 - 2. Size: 18 by 18 inches.
 - 3. Surface Color: Gray.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - WOOD DECK (R11 AND R12)

- A. Verify flatness and tightness of joints in wood decking; fill knot holes with latex filler.
- B. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.03 INSTALLATION, GENERAL

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.04 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

- A. Install vapor retarder to deck surface with adhesive in accordance with manufacturer's instructions.
 - 1. Roll entire surface of self-adhering vapor retarder with weighted roller.
 - 2. Extend vapor retarder under cant strips and blocking to deck edge.
 - 3. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.
 - 4. Protect vapor retarder from damage during subsequent roof installation activities.
- B. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.
- C. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- D. Do not install more insulation than can be covered with membrane in same day.
- E. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions.

3.05 INSTALLATION - MEMBRANE

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- D. Mechanical Attachment: Install membrane and mechanical attachment devices in accordance with manufacturer's instructions.
 - 1. Install mechanical fasteners at spacings recommended in writing by membrane manufacturer.
- E. At intersections with vertical surfaces:
 - 1. Fully adhere flexible flashing over membrane and up to nailing strips.
 - 2. Secure flashing to nailing strips at 4 inches on center.
- F. Around roof penetrations, seal flanges and flashings with flexible flashing.
 - 1. Use roof manufacturer's pre-fabricated boots where possible and field fabricated boot where not possible
- G. Apply cut-edge sealant at cut edges of reinforced membrane.
- H. Coordinate installation of roof drains and sumps and related flashings.

3.06 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Remove markings from finished surfaces.

- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 075400

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 077100 - Roof Specialties: Manufactured copings and flashings.
- B. Section 077200 - Roof Accessories: Manufactured metal roof curbs.

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2017.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- F. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing 2015a (Reapproved 2021).
- G. CDA A4050 - Copper in Architecture - Handbook current edition.
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal.
- B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.

1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
- C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.02 FABRICATION

- A. Fabricate roofing sheet metal to ANSI/SPRI/FM 4435/ES-1 requirements.
- B. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- C. Fabricate cleats of same material as sheet, minimum width as indicated on Drawings, interlocking with sheet.
- D. Form pieces in longest possible lengths.
- E. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- F. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- G. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.
- H. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.03 EXTERIOR PENETRATION FLASHING PANELS

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.04 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Underlayment: ASTM D2178/D2178M, glass fiber roofing felt.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric medium modulus silicone sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

- A. Comply with drawing details.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

- E. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, and in proper relationship with adjacent construction, and as follows:

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION 076200

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**SECTION 077100
ROOF SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufactured roof specialties, including copings and fascias.

1.02 RELATED REQUIREMENTS

- A. Section 077200 - Roof Accessories: Manufactured curbs, roof hatches, and snow guards.
- B. Section 076200 - Sheet Metal Flashing and Trim

1.03 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2017.
- C. NRCA (RM) - The NRCA Roofing Manual 2023.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- D. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 COMPONENTS

- A. Copings and Fascias: Factory fabricated to sizes required; corners mitered; concealed fasteners.
 - 1. Fabricate copings and edge metal to ANSI/SPRI/FM 4435/ES-1.
 - 2. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
 - 3. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
 - 4. Wall Width: As indicated on drawings.
 - 5. Outside Face Height: As indicated on drawings.
 - 6. Inside Face Height: As indicated on drawings.
 - 7. Material: Formed steel sheet, galvanized, 24 gauge, 0.024 inch thick, minimum.
 - 8. Finish: 70 percent polyvinylidene fluoride.
 - 9. Color: As selected by Architect from manufacturer's standard range.
- B. Pipe and Penetration Flashing: Base of rounded aluminum, compatible with sheet metal roof systems, and capable of accommodating pipes sized between 3/8 inch and 12 inches.
 - 1. Caps: EPDM.
 - 2. Color: As indicated on drawings.
- C. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

- D. Counterflashings: Factory fabricated and finished sheet metal that overlaps top edges of base flashing by at least 4 inches, and designed to snap into through-wall flashing or reglets with lapped joints. Where indicated:
 - 1. Material: Formed aluminum sheet, 0.025 inch thick, minimum.
 - 2. Material: Stainless steel sheet, 26 gauge, 0.019 inch thick, minimum.

2.02 FINISHES

- A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.03 ACCESSORIES

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.
- B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved in writing by roof membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Seal joints within components when required by component manufacturer.
- C. Anchor components securely.
- D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- E. Coordinate installation of flashing flanges into reglets.

END OF SECTION 077100

**SECTION 077200
ROOF ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof curbs.
- B. Equipment rails.
- C. Roof penetrations mounting curbs.
- D. Roof hatches.

1.02 RELATED REQUIREMENTS

- A. Section 077100 - Roof Specialties: Other manufactured roof specialty items.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Installation methods.
 - 2. Maintenance requirements.
- C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
 - 1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for roof hatches. Complete forms in Owner's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROOF CURBS

- A. Roof Curbs Manufacturers:
 - 1. AES Industries Inc: www.aescurb.com/#sle.
 - 2. The Pate Company: www.patecurbs.com/#sle.
 - 3. LMCurbs: www.lmcurbs.com/#sle.
 - 4. MKT Metal Manufacturing: www.mktduct.com/#sle.
 - 5. Roof Products & Systems (RPS): www.rpscurbs.com/#sle.
- B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
 - 1. Heights of curbs to be such that top of curb is not less than 8-inches above top surface of new roof system.
 - 2. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.
 - 3. Sheet Metal Material:
 - a. Galvanized Steel: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33; G60 coating designation; 18 gauge, 0.048 inch thick.

- 1) Finish: Factory primed.
4. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
 - a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch clearance between curb and metal roof panel flange allowing water to properly flow past curb.
 - b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
 - c. Maintain at least 12 inch clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
 - d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
5. Provide layouts and configurations indicated on drawings.
- C. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
- D. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.

2.02 ROOF HATCHES

- A. Roof Hatch Manufacturers:
 1. Acudor Products Inc: www.acudor.com/#sle.
 2. Babcock-Davis: www.babcockdavis.com/#sle.
 3. Best Access Doors: www.bestaccessdoors.com/#sle.
 4. Bilco Company: www.bilco.com/#sle.
- B. Roof Hatches: Factory-assembled galvanized steel frame and cover, complete with operating hardware.
 1. Style: Provide flat metal covers unless otherwise indicated.
 2. Mounting Substrate: Provide frames and curbs suitable for mounting on flat roof deck sheathing with insulation.
 3. Thermally Broken Hatches: Provide insulation within frame and cover.
 4. For Ladder Access: Double leaf; 30 by 36 inches.
- C. Ladder-Assist Safety Post: Roof-hatch manufacturer's standard spring balanced telescoping device for attachment to roof-access ladder.
 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
- D. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
 1. Material: Galvanized steel, 14 gauge, 0.0747 inch thick.
 2. Finish: Factory prime paint.
 3. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on outside face of curb.
 4. Curb Height: 12 inches from surface of roof deck, minimum.
- E. Metal Covers: Flush, insulated, hollow metal construction.
 1. Capable of supporting 40 psf live load.
 2. Material: Galvanized steel; outer cover 14 gauge, 0.0747 inch thick, liner 22 gauge, 0.03 inch thick.
 3. Finish: Factory prime paint.
 4. Insulation: Manufacturer's standard 1 inch rigid glass fiber.
 5. Gasket: Neoprene, continuous around cover perimeter.
- F. Safety Railing System: Roof hatch safety rail system mounted directly to curb without penetration of roofing system.
 1. Railing Size: As indicated on drawings.

2. Railing: Comply with 29 CFR 1910.23 for ladder safety, with a safety factor of two.
3. Self-Closing Gate: Comply with 29 CFR 1910.29 for safe egress and fall protection through hatch opening.
4. Posts and Rails: Galvanized steel tubing.
5. Gate: Same material as railing; automatic closing with latch.
6. Finish: Manufacturer's standard, factory applied finish.
7. Gate Hinges and Post Guides: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

- A. Clean installed work to like-new condition.

3.05 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 077200

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SECTION 078400 FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Firestopping systems.

1.02 REFERENCE STANDARDS

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2020a.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2020.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).
- H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- I. ITS (DIR) - Directory of Listed Products Current Edition.
- J. FM (AG) - FM Approval Guide Current Edition.
- K. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.
- L. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
- M. UL (DIR) - Online Certifications Directory Current Edition.
- N. UL (FRD) - Fire Resistance Directory Current Edition.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Installer's qualification statement.

1.04 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
- B. Installer Qualifications: Company specializing in performing the work of this section and:

1.05 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- D. Fire Ratings: Refer to drawings for required systems and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 - 2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 - 3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.
- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 - 1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
 - 2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
 - 3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
 - 4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.03 FIRESTOPPING SYSTEMS

- A. Firestopping: Any material meeting requirements.
 - 1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.
- C. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- D. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 078400

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**SECTION 079200
JOINT SEALANTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants 2017.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- F. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints 2019 (Reapproved 2020).
- G. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-- Tension 2016 (Reapproved 2021).
- H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- J. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 7. Sample product warranty.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Installer's qualification statement.
- F. Executed warranty.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nonsag Sealants:
 - 1. Bostik Inc: www.bostik-us.com/#sle.
 - 2. Dow: www.dow.com/#sle.
 - 3. Hilti, Inc: www.us.hilti.com/#sle.
 - 4. Pecora Corporation: www.pecora.com/#sle.
 - 5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 6. Sika Corporation: www.usa.sika.com/#sle.
 - 7. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
- B. Self-Leveling Sealants:
 - 1. Bostik Inc: www.bostik-us.com/#sle.
 - 2. Dow: www.dow.com/#sle.
 - 3. Pecora Corporation: www.pecora.com/#sle.
 - 4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
 - 5. Sika Corporation: www.usa.sika.com/#sle.
 - 6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
 - 7. W.R. Meadows, Inc: www.wrmeadows.com/#sle.

2.02 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
 - c. Other joints indicated below.
 - 3. Do not seal the following types of joints:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.

- c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
- d. Joints where installation of sealant is specified in another section.
- e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.

2.03 NONSAG JOINT SEALANTS

- A. Silicone Sealant: ASTM C920, Grade NS, Use T; single-component, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
 - 1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
- B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
 - 1. Color: White.
- C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
- D. Acrylic Latex Sealant: ASTM C834; for use as acoustical sealant and in firestopping systems for expansion joints and through penetrations.
 - 1. Color: To be selected by Architect from manufacturer's standard range.
 - 2. Fire Rated System: Complies with UL 263 and ASTM E119 with UL fire resistance classifications.

2.04 SELF-LEVELING JOINT SEALANTS

- A. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M, and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
 - 1. Movement Capability: Plus and minus 25 percent, minimum.
 - 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
 - 3. Color: To be selected by Architect from manufacturer's standard range.
 - 4. Tensile Strength: 200 to 250 psi in accordance with ASTM D412.
 - 5. Products:
 - a. Pecora Corporation; Urexpan NR-200: www.pecora.com/#sle.
 - b. Tremco Commercial Sealants & Waterproofing; THC-901: www.tremcosealants.com/#sle.

2.05 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant, ASTM C834; tested according to ASTM E90.
 - 1. Manufacturers:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant for Concealed Joints: Nondryinnonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended fo sealing interior concealed joints.
 - 1. Manufacturers:
 - a. Pecora Corporation; BA-98.
 - b. Tremco; Tremco Acoustical Sealant
- C. Acoustical Fire Rated Outlet Backer Pad
 - 1. Basis of Design: IsoBacker from Kinetics Noise Control.

2.06 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Clean substrates using the 2-Cloth Cleaning Method.
- D. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- E. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- E. At exterior joints, prime all porous substrates, including concrete, EIFS, steel, etc.
- F. Install backer rod 50 percent larger than joint; do not twist or double-up on backer rod to accommodate joint width.
- G. Install bond breaker backing tape where backer rod cannot be used.
- H. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- I. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- J. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- K. Tool sealant directly after application, prior to skin forming on surface; Do not use lubricants for assisting with tooling of sealant.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- C. Perform sealant pull testing in compliance with ASTM C1521, Test procedure, Method "A".
 - 1. Perform 1 test in first 1,000 linear feet of sealant applied to each substrate, and minimum 1 test for every 10,000 linear feet of sealant applied to each substrate

- D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION 079200

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**SECTION 079210
SECURITY JOINT SEALANTS**

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. Security Joint Sealant.
 - 2. Security Gap Filler.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 07 for typical building construction Sealants.
 - 2. Division 11 for Detention Equipment
 - 3. Division 22 for Plumbing
 - 4. Division 23 for Mechanical
 - 5. Division 26 for Electrical
 - 6. Division 28 for Electronic Safety and Security

1.03 SUBMITTALS

- A. Product Data: For each joint sealant product indicated.
 - 1. Certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds.
- B. Certificates by Manufacturer: That products supplied complies with performance requirements specified and are suitable for the use indicated.
- C. Samples: Supply two (2) samples size (6) inches long of actual material of each type of sealant, and in colors required for the project.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has a minimum of five (5) years of experience in successfully installing security sealants on projects of similar extent and scope to that indicated for Project that have resulted in construction with a record of successful in-service performance and using products similar to those specified herein.
- B. Provide all sealants from a single manufacturer.
- C. Prior to installation, Manufacturer's representatives shall meet at the project site for the purpose of reviewing products and installation methods selected, procedures to be followed in performing the work, and coordination with other trades.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.06 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.

2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4.4 deg C).
 3. When joint substrates are wet.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than or more than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

1.07 WARRANTY

- A. Furnish a written warranty against defects of materials and workmanship for specified periods. Defects include but are not limited to changes in the structural, physical or chemical properties of the sealant materials that impair function or require abnormal maintenance, changes in surface finish, color or texture, failure in adhesion, weather resistance or durability, failure to prevent entry of water, or failure to comply with specified requirements.
1. Exterior Sealants: 10-years from Date of Substantial Completion.
 2. Interior Sealants: 5-years from Date of Substantial Completion.
- B. This warranty shall not cover formation of cracks or defects in substrate materials adjacent to the seal, joint movement in excess of movement rating of sealant, or physical damage caused by others.
- C. Repair or replace defective materials and workmanship during warranty period without expense to Owner, including removal and replacement of other items as required.
- D. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents

1.08 APPLICABLE REFERENCE STANDARDS

- A. ASTM C881 "Shear Strength"
- B. ASTM D638 "Tensile Strength"
- C. ASTM D648 "Heat Deflection Temperature"
- D. ASTM D695 "Compressive Yield Strength"

PART 2 PRODUCTS

2.01 MATERIALS

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
1. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

2.02 SECURITY JOINT SEALANT (SJS)

- A. Product/Manufacturer:
1. SikaFlex -2c NS TG/ Sika Corp.
 2. DynaFlex/ Pecora Corp.
 3. MasterSeal CR 195/ BASF

2.03 SECURITY EPOXY RESIN GAP FILLER (LOW-MOD GEL) – (SGF)

- A. Product/Manufacturer:
1. Sika-Dur 23/ Sika Corp.
 2. DynaPoxy EP 1200 / Pecora Corp.
 3. MasterEmaco ADH 327/ BASF
- B. Materials
1. Epoxy resin adhesive binder:

- a. Component "A" shall be a modified epoxy resin of the epichlorohydrin bisphenol A type containing suitable viscosity control agents. It shall not contain butyl glycidyl ether.
 - b. Component "B" shall be a blend of aliphatic amines containing suitable viscosity control agents, pigments and accelerators.
 - c. The ratio of Component "A": Component "B" shall be 1:1 by volume.
 - d. The material shall not contain asbestos.
- C. Performance Criteria
1. Properties of the mixed epoxy resin adhesive:
 - a. Pot Life: 45-65 minutes
 - b. Tack-Free Time to Touch (20 mil thickness): 1.5-2.5 hours
 - c. Consistency (½ in. thick) : non-sag
 - d. Color: gray
 2. Properties of the mixed epoxy resin adhesive:
 - a. Compressive Properties (ASTM D-695) at 28 days
 - b. Compressive Strength: 4400 psi min
 - c. Modulus of Elasticity: 1.5 x 10⁵ psi min
 - d. Tensile Properties (ASTM D-638) at 14 days:
 - 1) Tensile Strength: 1725 psi min
 - 2) Elongation at Break: 5.5% min
 - 3) Modulus of Elasticity: 2.7 x 10⁵ psi min
 - e. Flexural Properties (ASTM D-790) at 14 days:
 - 1) Flexural Strength (Modulus of Rupture): 4100 psi min.
 - 2) Tangent Modulus of Elasticity in Bending: 4.0 x 10⁵ psi min
 - f. Shear Strength (ASTM D-732) at 14 days: 2600 psi min
 - g. Total Water Absorption (ASTM D-570) at 7 days: .5% max. (2 hour boil)
 - h. Bond Strength (ASTM C-882) Hardened Concrete to Hardened Concrete:
 - 1) 2 day (Dry cure): 2200 psi min
 - 2) 14 day (moist cure): 1500 psi min
 - i. Deflection Temperature (ASTM D-648) at 14 days: 87F min (fiber stress loading = 66 psi)
 - j. The epoxy resin adhesive shall conform to ASTM C-881 and AASHTO M 235-90.
 - k. The epoxy resin adhesive binder shall be approved by the United States Department of Agriculture.
 3. Properties of the epoxy resin mortar (epoxy resin/aggregate* =1/1 by loose volume):
 - a. Compressive Properties (ASTM D-695) at 28 days:
 - 1) Compressive Strength: 6100 psi min.
 - 2) Modulus of Elasticity: L 3.4 x 10⁵ psi min.
 - b. Tensile Properties (ASTM D-638) at 14 days:
 - 1) Tensile Strength: 2050 psi min.
 - 2) Elongation at Break: 0.85% min.
 - 3) Modulus of Elasticity: 5.2 x 10⁵ psi min.
 - c. Flexural Properties (ASTM D-790) at 14 days:
 - 1) Flexural Strength (Modulus of Rupture): 3300 psi min.
 - 2) Tangent Modulus of Elasticity in Bending: 5.8 x 10⁵ psi min.
 - d. Shear Strength (ASTM D-732) at days: 2800 psi min.
 - e. Aggregate used shall conform to ASTM C-190.

2.04 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.05 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 in any way joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.01 LOCATIONS

- A. Provide security joint sealants and security gap filler work as required under the General, Mechanical, and Electrical Sections.
- B. Surface mounted items below 10' high on exterior walls, floors, including lights, horns, camera mounts, louvers, grilles, as indicated on or within secure perimeter of the Facility.
- C. Surface mounted items below 10' high on interior walls, floors or ceilings. Including surface mounted lights, grilles, registers, cover plates, enclosures, housings, cell mirrors, shelves, wall bumpers, cover plates, speaker covers, sprinkler heads, etc as indicated on or within secure perimeter of the Facility.
- D. Joints between floors, walls and ceilings in cells, dayrooms, search rooms, holding rooms, inmate toilet rooms and showers.
- E. Joints between precast concrete panels, masonry walls and metal wall panels / modular cells in inmate accessible areas, other than in cells.
- F. Joints between perimeter ledger angles and metal ceiling panels and adjacent walls.
- G. Joints between metal ceiling panels
- H. Exposed control joints in dayrooms, outdoor rec yard and other inmate accessible areas.
- I. Joints between metal opening frames and walls.
- J. Gaps between security plumbing fixtures, floors, and walls
- K. Other areas / items as defined in the Sealant Matrix.

3.02 SEALANT MATRIX:

LOCATIONS	INMATE CORRIDORS WITHIN SECURE PERIMETER	CELLS, HOLDING CELLS SEARCH ROOMS, WITHIN SECURE PERIMETER
DETENTION HOLLOW METAL FRAMES	SGF	SGF
MECH. GRILLES / DIFFUSERS	SGF	SGF
SECURITY SINKS / SHOWERS	SGF	SGF
WATER CLOSETS / LAVATORIES	SGF	SGF
SPRINKLER HEADS / PLUMBING	SGF	SGF
SECURITY LIGHT FIXTURES	SGF	SGF

SWITCHES / OUTLETS	SJS	SGF
DURESS PLATES	SJS	SGF
DETENTION EQUIPMENT / FURNISHINGS	SJS	SGF
WALL AND CEILING JOINTS	SGF / SJS	SGF
SECURITY GLAZING TO DETENTION HOLLOW METAL DOOR / FRAME	LJS	LJS
NOTES: LJS = LATEX JOINT SEALANT - REFER TO DIVISION 07 FOR NON-SECURITY JOINT SEALANTS SJS - SECURITY JOINT SEALANT SGF - SECURITY GAP FILLER NOTE: REFER TO DRAWINGS FOR DEFINITIOIN OF SECURE PERIMETER		

3.03 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 joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.04 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer 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 concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, 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 from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
 3. Remove laitance and form release agents from concrete.
 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. 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 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.

3.05 INSTALLATION OF JOINT SEALANTS

- A. Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

3.06 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.07 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that and installations with repaired areas are indistinguishable from original work.

END OF SECTION 079210

**SECTION 079513
EXPANSION JOINT COVER ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Expansion joint cover assemblies for floor, wall, and ceiling surfaces.

1.02 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles 2020.
- D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- E. ITS (DIR) - Directory of Listed Products Current Edition.
- F. UL (DIR) - Online Certifications Directory Current Edition.
- G. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
- C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.
- D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Expansion Joint Cover Assemblies:
 - 1. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 - 2. Inpro: www.inprocorp.com/#sle.
 - 3. Nystrom, Inc: www.nystrom.com/#sle.

2.02 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
 - 1. Joint Dimensions and Configurations: As indicated on drawings.
 - 2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
 - 3. Joint Cover Styles: As indicated on drawings.
 - 4. Joint Movement Capability: If not indicated, provide minimum plus/minus 25 percent joint movement capability.
 - 5. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
 - 6. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.
- B. Floor Joint Covers: Coordinate with indicated floor coverings.

- C. Resilient Seal Type Covers: Having flat exposed surface without crevices that could collect dirt; designed to withstand expected movement without extrusion of seal from joint assembly; for floors, provide style that is flush with top of floor covering; for exterior joints, weathertight.
- D. Sliding Cover Plate Type Covers: Provide plate with beveled edges and neat fit that does not collect dirt.
- E. Covers in Gypsum Board Assemblies: Provide style with anchoring wings that can be completely covered by joint compound.
- F. Covers in Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
 - 1. Acceptable Evaluation Agencies: UL (DIR) and ITS (DIR).

2.03 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
 - 1. Exposed Finish at Floors: Mill finish or natural anodized.
 - 2. Exposed Finish at Walls and Ceilings: Natural anodized.
- B. Resilient Seals:
 - 1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.
- C. Anchors and Fasteners: As recommended by cover manufacturer.
- D. Threaded Fasteners: Aluminum.
- E. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

2.04 ACCESSORIES

- A. Resilient Fire Barrier: For use with metal expansion joint covers and elastomeric seals without use of mechanical fasteners, with fire rating in accordance with surrounding construction performance capabilities.
 - 1. Application: As indicated on Drawings.
 - 2. Fire Resistance Rating: As indicated on Drawings, in accordance with ASTM E1966 and UL 2079.
 - 3. Joint Opening: As indicated on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
- B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.02 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor to substrate to prevent misalignment.

3.03 PROTECTION

- A. Do not permit traffic over unprotected floor joint surfaces.
- B. Provide strippable coating to protect finish surface.

END OF SECTION 079513

**SECTION 081113
HOLLOW METAL DOORS AND FRAMES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

- A. 012300 - Alternates: For alternates affecting this section; detention doors and frames.
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glazing: Glass for doors and borrowed lites.
- D. Section 111908 - Security Glazing: Alternate Bid.
- E. Section 111913 - Detention Hollow Metal Doors and Frames

1.03 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. SDI: Steel Door Institute.

1.04 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2022.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.
- I. ASTM C476 - Standard Specification for Grout for Masonry 2023.
- J. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames 2016.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- L. ITS (DIR) - Directory of Listed Products Current Edition.
- M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
- O. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.
- P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.

- Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
- S. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2023.
- T. UL (DIR) - Online Certifications Directory Current Edition.
- U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years documented experience.
- B. Provide hollow metal frames from SDI Certified manufacturer.
- C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hollow Metal Doors and Frames:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
 - 3. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
 - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
 - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
 - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
 - 4. Door Edge Profile: Manufacturer's standard for application indicated.
 - 5. Typical Door Face Sheets: Flush.
 - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.

7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
 - a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Hollow Metal Panels: Same construction, performance, and finish as doors.
- C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
 3. Door Thickness: 1-3/4 inches, nominal.
- C. Interior Doors, Non-Fire-Rated:
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
 2. Door Thickness: 1-3/4 inches, nominal.
- D. Fire-Rated Doors:
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 14 gauge, 0.067 inch, minimum.
 2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
 4. Provide units listed and labeled by UL (DIR) or ITS (DIR).
 - a. Attach fire rating label to each fire rated unit.
 5. Door Thickness: 1-3/4 inches, nominal.
- E. Maximum Duty Doors (Alternate No. 5):
 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

- a. Level 4 - Maximum-duty.
- b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
- c. Model 1 - Full Flush.
- d. Door Thickness: 1-3/4 inch, nominal.
- e. Door Face Metal Thickness: 14 gauge, 0.067 inch, minimum.

2.04 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Exterior Door Frames: Face welded type.
 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
 3. Frame Finish: Factory primed and field finished.
 4. Weatherstripping: Separate, see Section 087100.
- C. Interior Door Frames, Non-Fire Rated: Face welded type.
 1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
 2. Frame Finish: Factory primed and field finished.
- D. Interior Door Frames for the Maximum Duty Doors (Alternate No. 5):
 1. Interior Door Frames, Non-Fire Rated: Face welded type.
 2. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
 3. Frame Finish: Factory primed and field finished.
- E. Door Frames, Fire-Rated: Face welded type.
 1. Fire Rating: Same as door, labeled.
- F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

2.05 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
 1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.06 ACCESSORIES

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 1. Size: As indicated on drawings.
 2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
 3. Metal Finish: Beige polyester powder coating.
- B. Glazing:
 1. General As specified in Section 088000, factory installed.
 2. Maximum Duty Doors (Alternate No. 5): 111908 - Security Glazing.
- C. Astragals for Double Doors: Specified in Section 08 7100.
- D. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
- E. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 087100.
- F. Comply with glazing installation requirements of Section 088000.

3.04 TOLERANCES

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

- A. Adjust for smooth and balanced door movement.

END OF SECTION 081113

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**SECTION 081416
FLUSH WOOD DOORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush wood doors; flush configuration; fire-rated, non-rated, and acoustical.

1.02 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames: Door Frames.

1.03 REFERENCE STANDARDS

- A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- C. ASTM E413 - Classification for Rating Sound Insulation 2022.
- D. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- E. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2021, with Errata (2022).

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- E. Test Reports: Show compliance with specified requirements for the following:
 - 1. Sound-retardant doors and frames; sealed panel tests are not acceptable.
- F. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
 - 1. Company with at least one project within past five years with value of woodwork within at least 20 percent of cost of woodwork for this project.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
 - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. High Pressure Decorative Laminate (HPDL) Faced Doors:
 - 1. AJW Architectural Products: www.ajw.com/#sle.
 - 2. Oregon Door: www.oregondoor.com/#sle.
 - 3. Masonite Architectural: www.architectural.masonite.com/#sle.
 - 4. VT Industries, Inc: www.vtindustries.com/#sle.

2.02 DOORS AND PANELS

- A. Doors: See drawings for locations and additional requirements.
 - 1. Quality Standard: Custom Grade Grade, Duty performance as indicated, in accordance with WDMA I.S. 1A:
 - a. Provide heavy duty performance for offices including judges chambers, small toilet rooms, quiet rooms, small waiting rooms, small conference rooms, small break rooms, closets and storage.
 - b. Provide extra-heavy duty performance at circulation, sound locks, larger break rooms, janitor closets, larger public toilet rooms, and assembly spaces including courtroom, large conference rooms, jury assembly rooms, and hearing rooms.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at each location.
 - 2. Sound-Rated Doors: Minimum STC as indicated on drawings, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
- C. Sound-Rated Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

- A. High Pressure Decorative Laminate (HPDL) Facing for Fire Doors: NEMA LD 3, SGF; color as selected; finish as selected.
- B. High Pressure Decorative Laminate (HPDL) Facing for Non-Fire-Rated Doors: NEMA LD 3, HGS; color as selected; finish as selected.
- C. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Provide solid blocks at lock edge for hardware reinforcement.
 - 2. Provide solid blocking for other throughbolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- G. Cut and configure exterior door edge to receive recessed weatherstripping devices.
- H. Provide edge clearances in accordance with the quality standard specified.

2.06 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 081113.
- B. Glazed Openings:
 - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
 - 2. Tint: Clear.
- C. Door Window Frames: Door window frames with glazing securely fastened within door opening.
 - 1. Size: As indicated on drawings.
 - 2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
 - 3. Metal Finish: Polyester powder coating, color matching door finish.
 - 4. Glazing: 1/4 inch thick, tempered glass, in compliance with requirements of authorities having jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.

3.03 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

END OF SECTION 081416

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**SECTION 083100
ACCESS DOORS AND PANELS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access doors and panels.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

PART 2 PRODUCTS

2.01 WALL- AND CEILING-MOUNTED ACCESS UNITS

- A. Manufacturers:
 - 1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
 - 2. ACUDOR Products Inc: www.acudor.com/#sle.
 - 3. Babcock-Davis: www.babcockdavis.com/#sle.
 - 4. BAUCO Access Panel Solutions Inc: www.accesspanelsolutions.com/#sle.
- B. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
 - 1. Material: Steel.
 - 2. Style: Recessed door panel for infill with wall/ceiling finish.
 - a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
 - 3. Door Style: Single thickness with rolled or turned in edges.
 - 4. Heavy-Duty Frames: 14-gauge, 0.0747-inch minimum thickness.
 - 5. Steel Finish: Primed.
 - 6. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
 - 7. Hardware:
 - a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
 - b. Latch/Lock: Screw driver slot for quarter turn cam latch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION 083100

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**SECTION 084313
ALUMINUM-FRAMED STOREFRONTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.

1.02 RELATED REQUIREMENTS

- A. Section 084413 - Glazed Aluminum Curtain Walls.
- B. Section 087100 - Door Hardware: Hardware items other than specified in this section.
- C. Section 088000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.
- B. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.
- C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.
- F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- I. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- L. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
- M. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2023).
- O. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015 (Reapproved 2023).
- P. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
 - 1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- D. Manufacturer's installation instructions.
- E. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Designer's qualification statement.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Idaho.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Aluminum-Framed Storefronts:
 - 1. Kawneer North America: www.kawneer.com/#sle.
 - 2. Basis of Design: Oldcastle BuildingEnvelope; 6000 XT: www.oldcastlebe.com/#sle.
 - 3. YKK AP America, Inc: www.ykkap.com/commercial/#sle.

2.02 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Rabbet: For 1 inch insulating glazing.
 - 2. Glazing Position: Centered (front to back).
 - 3. Vertical Mullion Dimensions: 2 inches wide by 4 inches deep.
 - 4. Finish:

- a. Exterior Frames: Class I color anodized.
 - b. Interior Frames: Class I natural anodized.
 - c. Factory finish all surfaces that will be exposed in completed assemblies.
 - d. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
5. Finish Color:
 - a. Exterior Frames: Bronze.
 - b. Interior Frames: Clear.
 6. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 8. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 9. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 10. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of ASCE 7.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
 3. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 6.27 psf pressure difference.
 4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
 5. Overall U-value Including Glazing: 0.350 Btu/(hr sq ft deg F), maximum.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
 2. Glazing Stops: Flush.
 3. Cross-Section: As indicated on drawings.
 4. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: See Section 088000.
- C. Swing Doors: Glazed aluminum.
1. Thickness: 1-3/4 inches.
 2. Door Style: Wide; 5 inches.
 3. Bottom Rail: 10 inches wide.
 4. Finish: Same as storefront.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
- D. Fasteners: Stainless steel.
- E. Concealed Flashings: Dead soft stainless steel, 26 gauge, 0.0187 inch minimum thickness.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- H. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.
- B. Color: As selected by Architect.

2.06 HARDWARE

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: See Section 087100.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.
- E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.
- F. Pivots: Offset type; top and bottom.
 - 1. Provide on doors as indicated.
- G. Door Closers: Concealed overhead.
 - 1. Provide on doors as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 088000.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

- A. Provide services of storefront manufacturer's field representative to observe for proper installation of system and submit report.
- B. See Section 014000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- C. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
 - 3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.
 - a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
- D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 084313

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**SECTION 084413
GLAZED ALUMINUM CURTAIN WALLS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed curtain wall, with vision glazing and glass and metal infill panels.
- B. Firestopping between curtain wall and edge of floor slab.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping: Firestop at system junction with structure.
- B. Section 084313 - Aluminum-Framed Storefronts: Entrance framing and doors.
- C. Section 088000 - Glazing.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.
- B. AAMA 501.4 - Recommended Static Test Method for Evaluating Window Wall, Curtain Wall and Storefront Systems Subjected to Seismic and Wind-Induced Inter-Story Drift 2018.
- C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems 2014.
- D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference 2015 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

- D. Manufacturer's installation instructions.
- E. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.
- F. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Designer's Qualification Statement.
- I. Installer's Qualification Statement.
- J. Warranty: At closeout, submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer. See Section 017800 - Closeout Submittals.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at Idaho.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design: Oldcastle Building Envelope.
- B. Other Acceptable - Glazed Aluminum Curtain Walls Manufacturers:
 - 1. Kawneer North America: www.kawneer.com/#sle.
 - 2. YKK AP America, Inc: www.ykkap.com/commercial/#sle.

2.02 CURTAIN WALL

- A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Outside glazed, with pressure plate and mullion cover, where indicated on drawings.
 - 2. Fabrication Method: Field fabricated stick system.
 - 3. Glazing Method: Field glazed system.
 - 4. Vertical Mullion Dimensions: 2-1/2 inches by 10-3/8 inches.
 - 5. Finish: Class I color anodized, color as selected by Architect.
 - a. Factory finish surfaces that will be exposed in completed assemblies.

- b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
 6. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 8. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
 1. Design Wind Loads: Comply with the requirements of ASCE 7 and design criteria as noted on Structural Drawings.
 - a. Measure performance by testing in accordance with ASTM E330/E330M, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.
 - b. Member Deflection: For spans less than 13 feet 6 inches, limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch, whichever is less and with full recovery of glazing materials.
 - c. Member Deflection: For spans over 13 feet 6 inches and less than 40 feet, limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch, with full recovery of glazing materials.
 2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement in accordance with requirements of ASCE 7 and design criteria as noted on Structural Drawings..
 3. Interstory Differential Lateral Movement: Meeting pass/fail criteria of AAMA 501.4 for Use Group I, Standard Occupancy, when tested at design displacement of 0.010 times greater adjacent story height, maximum, and 1.5 times design displacement, through three complete cycles.
 4. Movement: Accommodate the following movement without damage to components or deterioration of seals:
 - a. Expansion and contraction caused by 180 degrees F surface temperature.
 - b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.
 - c. Movement of curtain wall relative to perimeter framing.
 - d. Deflection of structural support framing, under permanent and dynamic loads.
- C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
- D. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
 1. Static Test Pressure Differential: 15 psf.
- E. Air Leakage: 0.06 cfm/sq ft maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.27 psf pressure difference across assembly.
- F. Thermal Performance Requirements:
 1. Overall U-value Including Glazing: 0.356 Btu/(hr sq ft deg F), maximum.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 1. Cross-Section: As indicated on drawings.
 2. Structurally Reinforced Members: As required; Extruded aluminum with internal reinforcement of structural steel member.

- a. Refer to door sub-frames as depicted on Drawings
- B. Glazing: See Section 088000.
- C. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
 - 1. Basis of Design: Mapes R Infill Panels.
 - 2. Core: Polyisocyanurate insulation core with R-value of 6 per inch.
 - 3. Substrate: Cement board, 4 mm thick.
 - 4. Overall Thickness: 1 inch.
 - 5. Exterior Finish: Custom color as selected by Architect.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Fasteners: Stainless or cadmium plated steel; type as required or recommended in writing by curtain wall manufacturer.
- D. Concealed Flashings: Dead soft stainless steel, 26 gauge, 0.0187 inch minimum thickness, or type recommended by manufacturer.
- E. Firestopping: See Section 078400.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.
- G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- H. Glazing Accessories: See Section 088000.

2.05 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other related work.
- B. Verify that curtain wall openings and adjoining water-resistive and air barrier seal materials are ready to receive work of this section.
- C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

- A. Install curtain wall system in accordance with manufacturer's written instructions.
 - 1. Install pressure bar fasteners with electric drivers with designated power source (generator.) Do not use battery powered drivers. Check torque on pressure bar fastener intermittently during installation with digital torque wrench, not less than once every 100 fasteners installed. Adjust driver torque setting as necessary.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Install firestopping at each floor slab edge.

- H. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 1/8 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.
- C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.04 FIELD QUALITY CONTROL

- A. Provide services of curtain wall manufacturer's field representative to observe for proper installation of system and submit report.
- B. See Section 014000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.
- C. Provide field testing of installed curtain wall system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.
 - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
 - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
 - 3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 8.0 psf.
 - a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.
- D. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

- A. Adjust operating sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.

3.07 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 084413

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**SECTION 087100
DOOR HARDWARE**

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Mechanical and electrified door hardware
 - 2. Electronic access control system components
- B. Section excludes:
 - 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
 - 4. Toilet accessories
 - 5. Overhead doors
- C. Related Sections:
 - 1. Division 01 Section "Alternates" for alternates affecting this section.
 - 2. Division 06 Section "Rough Carpentry"
 - 3. Division 06 Section "Finish Carpentry"
 - 4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - c. "Interior Aluminum Doors and Frames"
 - d. "Aluminum-Framed Entrances and Storefronts"
 - e. "Entrances"
 - 6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
 - 7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

- A. UL LLC
 - 1. UL 10B - Fire Test of Door Assemblies
 - 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 - Air Leakage Tests of Door Assemblies
 - 4. UL 305 - Panic Hardware
- B. DHI - Door and Hardware Institute
 - 1. Sequence and Format for the Hardware Schedule
 - 2. Recommended Locations for Builders Hardware
 - 3. Keying Systems and Nomenclature
 - 4. Installation Guide for Doors and Hardware
- C. NFPA – National Fire Protection Association
 - 1. NFPA 70 – National Electric Code
 - 2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
 - 3. NFPA 101 – Life Safety Code
 - 4. NFPA 105 – Smoke and Draft Control Door Assemblies
 - 5. NFPA 252 – Fire Tests of Door Assemblies
- D. ANSI - American National Standards Institute
 - 1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
 - 2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

- A. General:
 1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
 2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
- B. Action Submittals:
 1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
 2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
 3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
 4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
 5. Key Schedule:

- a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
- C. Informational Submittals:
1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.
- D. Closeout Submittals:
1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
- E. Inspection and Testing:
1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. Fire door assemblies, in compliance with NFPA 80.
 - b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

- A. Qualifications and Responsibilities:
1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
 3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

- a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.
- B. Certifications:
1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
 2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
 3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
 4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
 2. Pre-installation Conference
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
 3. Electrified Hardware Coordination Conference:

- a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - (a) Schlage L Series: 3 years
 - (b) Schlage ND Series: 10 years
 - 2) Exit Devices
 - (a) Von Duprin: 3 years
 - 3) Closers
 - (a) LCN 4000 Series: 30 years
 - (b) LCN 4050 Series: 25 years
 - 4) Automatic Operators
 - (a) LCN: 2 years
 - b. Electrical Warranty
 - 1) Locks
 - (a) Schlage: 1 year
 - 2) Exit Devices

(a) Von Duprin: 1 year

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- B. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

- A. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.
- C. Cable and Connectors:
 - 1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
 - 2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
 - 3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
 - 2. Acceptable Manufacturers and Products:
 - a. Best FBB series
- B. Requirements:
 - 1. Provide hinges conforming to ANSI/BHMA A156.1.
 - 2. Provide five knuckle, ball bearing hinges.

3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
 - b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

- A. Manufacturers:
 1. Scheduled Manufacturer and Product:
 - a. Ives 700 series
 2. Acceptable Manufacturers:
 - a. Best
- B. Requirements:
 1. Provide pin and barrel continuous hinges conforming to ANSI/BHMA A156.26., Grade 1.
 2. Provide pin and barrel continuous hinges fabricated from 14-gauge, type 304 stainless steel.
 3. Provide twin self-lubricated nylon bearings at each hinge knuckle, with 0.25-inch (6 mm) diameter stainless steel pin.
 4. Provide hinges capable of supporting door weights up to 600 pounds, and successfully tested for 1,500,000 cycles.
 5. On fire-rated doors, provide pin and barrel continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
 6. Provide pin and barrel continuous hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
 7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 CONTINUOUS HINGES

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Best
- B. Requirements:
 1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.

2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.06 ELECTRIC POWER TRANSFER

- A. Manufacturers:
 1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10
 2. Acceptable Manufacturers and Products:
 - a. Precision EPT-12C
- B. Requirements:
 1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
 2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.07 FLUSH BOLTS

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Rockwood
 - b. Trimco
- B. Requirements:
 1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.08 MORTISE LOCKS

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series
 2. Acceptable Manufacturers and Products:
 - a. Best 45H series
- B. Requirements:
 1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
 2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.

3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches.
7. Provide motor based electrified locksets that comply with the following requirements:
 - a. Universal input voltage – single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
 - b. Fail Safe/Fail Secure – changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case.
 - c. Low maximum current draw – maximum 0.4 amps to allow for multiple locks on a single power supply.
 - d. Low holding current – maximum 0.01 amps to produce minimal heat, eliminate “hot levers” in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
 - e. Connections – provide quick-connect Molex system standard.
8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Lever Design: 03A.

2.09 CYLINDRICAL LOCKS – GRADE 1

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Schlage ND series
 2. Acceptable Manufacturers and Products:
 - a. Best 9K series
- B. Requirements:
 1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
 2. Cylinders: Refer to "KEYING" article, herein.
 3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
 4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 7. Provide electrified options as scheduled in the hardware sets.
 8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design: Tubular.

2.10 EXIT DEVICES

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 98/35A series
 2. Acceptable Manufacturers and Products:
 - a. Precision APEX 2000 series
- B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide smooth touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
16. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.11 ELECTRIC STRIKES

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Von Duprin 6000 Series
 2. Acceptable Manufacturers and Products:
 - a. dormakaba RCI series
- B. Requirements:
 1. Provide electric strikes designed for use with type of locks shown at each opening.
 2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
 3. Where required, provide electric strikes UL Listed for fire doors and frames.
 4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.12 PASSIVE INFRARED MOTION SENSORS

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. Schlage SCAN II Series
 2. Acceptable Manufacturers and Products:
 - a. dormakaba
- B. Requirements:
 1. Provide motion sensors as specified in hardware groups.

2.13 POWER SUPPLIES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Schlage/Von Duprin PS900 Series
 - 2. Acceptable Manufacturers and Products:
 - a. Precision ELR series
- B. Requirements:
 - 1. Provide power supplies approved by manufacturer of supplied electrified hardware.
 - 2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
 - 3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
 - 4. Provide power supplies with the following features:
 - a. 12/24 VDC Output, field selectable.
 - b. Class 2 Rated power limited output.
 - c. Universal 120-240 VAC input.
 - d. Low voltage DC, regulated and filtered.
 - e. Polarized connector for distribution boards.
 - f. Fused primary input.
 - g. AC input and DC output monitoring circuit w/LED indicators.
 - h. Cover mounted AC Input indication.
 - i. Tested and certified to meet UL294.
 - j. NEMA 1 enclosure.
 - k. Hinged cover w/lock down screws.
 - l. High voltage protective cover.

2.14 CYLINDERS

- A. Manufacturers:
 - 1. Scheduled Manufacturer and Product:
 - a. Best small format interchangeable system with keyway per Owner's request
 - 2. Acceptable Manufacturers and Products:
 - a. Per Owner/Architect's approval
- B. Requirements:
 - 1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.15 KEYING

- A. Scheduled System:
 - 1. Existing factory registered system:
 - a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
- B. Requirements:
 - 1. Construction Keying:
 - a. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - (a) 3 construction control keys
 - (b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward biting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - 3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 - e. Quantity: Furnish in the following quantities.
 - 1) Change (Day) Keys: 3 per cylinder/core.
 - 2) Permanent Control Keys: 3.
 - 3) Master Keys: 6.

2.16 KEY CONTROL SYSTEM

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Telkee
 2. Acceptable Manufacturers:
 - a. HPC
 - b. Lund
- B. Requirements:
 1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
 - a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
 - b. Provide hinged-panel type cabinet for wall mounting.

2.17 DOOR CLOSERS

- A. Manufacturers and Products:
 1. Scheduled Manufacturer and Product:
 - a. LCN 4040XP series
 2. Acceptable Manufacturers and Products:
 - a. Best QDC 100 series
- B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.18 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. LCN 4050A series
2. Acceptable Manufacturers and Products:
 - a. Best QDC series

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 mm) diameter with 11/16-inch (17 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and all weather requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: Not permitted.
8. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.19 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:

- a. LCN 4600 series
2. Acceptable Manufacturers and Products:
 - a. Precision D4990 series
- B. Requirements:
 1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
 2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
 3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
 4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
 5. Provide drop plates, brackets, and adapters for arms as required for details.
 6. Provide actuator switches and receivers for operation as specified.
 7. Provide weather-resistant actuators at exterior applications.
 8. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
 9. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
 10. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.20 DOOR TRIM

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood
- B. Requirements:
 1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.21 PROTECTION PLATES

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Ives
 2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood
- B. Requirements:
 1. Provide protection plates with a minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
 2. Sizes plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
 3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.22 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

- A. Manufacturers:
 - 1. Scheduled Manufacturers:
 - a. Glynn-Johnson
 - 2. Acceptable Manufacturers:
 - a. dormakaba
- B. Requirements:
 - 1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.
 - 2. Provide friction type at doors without closer and positive type at doors with closer.

2.23 DOOR STOPS AND HOLDERS

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Ives
 - 2. Acceptable Manufacturers:
 - a. Trimco
 - b. Rockwood
- B. Provide door stops at each door leaf:
 - 1. Provide wall stops wherever possible. Provide concave type where lockset has a push button or thumbturn.
 - 2. Where a wall stop cannot be used, provide universal floor stops.
 - 3. Where wall or floor stop cannot be used, provide overhead stop.
 - 4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.24 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Zero International
 - 2. Acceptable Manufacturers:
 - a. National Guard
 - b. Pemko
- B. Requirements:
 - 1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
 - 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
 - 4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.25 SILENCERS

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Ives
 - 2. Acceptable Manufacturers:
 - a. Rockwood
 - b. Trimco
- B. Requirements:
 - 1. Provide "push-in" type silencers for hollow metal or wood frames.

2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.26 MAGNETIC HOLDERS

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. LCN
 2. Acceptable Manufacturers:
 - a. dormakaba
- B. Requirements:
 1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.27 DOOR POSITION SWITCHES

- A. Manufacturers:
 1. Scheduled Manufacturer:
 - a. Schlage
 2. Acceptable Manufacturers:
 - a. dormakaba
- B. Requirements:
 1. Provide recessed or surface mounted type door position switches as specified.
 2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.28 FINISHES

- A. FINISH: BHMA 626/652 (US26D); EXCEPT:
 1. Hinges at Exterior Doors: BHMA 630 (US32D)
 2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
 3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
 4. Protection Plates: BHMA 630 (US32D)
 5. Overhead Stops and Holders: BHMA 630 (US32D)
 6. Door Closers: Powder Coat to Match
 7. Wall Stops: BHMA 630 (US32D)
 8. Latch Protectors: BHMA 630 (US32D)
 9. Weatherstripping: Clear Anodized Aluminum
 10. Thresholds: Mill Finish Aluminum

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
 - 1. Install construction cores to secure building and areas during construction period.
 - 2. Replace construction cores with permanent cores as indicated in keying section.
 - 3. Furnish permanent cores to Owner for installation.
- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- L. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- M. Closer/holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- N. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- O. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

- Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- R. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- S. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.


3.05 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

3.06 HARDWARE SETS:

3.06 DOOR HARDWARE SCHEDULE

Legend:















-  Link to catalog cut sheet
-  Electrified Opening

HARDWARE GROUP NO. 01

For use on Door #(s):

10.301

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
2	EA	MANUAL FLUSH BOLT	FB457		626	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED		626	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS18L		BLK	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429 @ HEAD & JAMBS		AA	ZER
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	ASTRAGAL	43STST		STST	ZER
1	EA	THRESHOLD	655A -OR AS REQUIRED BY SILL DETAIL		A	ZER
2	EA	DOOR CONTACT	679-05HM	 	BLK	SCE

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED

DOOR IS MONITORED THROUGH ACCESS CONTROL OR SECURITY SYSTEM

FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 01A

For use on Door #(s):

10.107

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
2	EA	MANUAL FLUSH BOLT	FB457		626	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED		626	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	FLOOR STOP	FS18L		BLK	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429 @ HEAD & JAMBS		AA	ZER
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	ASTRAGAL	43STST		STST	ZER
1	EA	THRESHOLD	655A -OR AS REQUIRED BY SILL DETAIL		A	ZER
2	EA	DOOR CONTACT	679-05HM		✎ BLK	SCE

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
DOOR IS MONITORED THROUGH ACCESS CONTROL OR SECURITY SYSTEM
FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 04

For use on Door #(s):

1.102-A 1.102-B C101-B C102-A C201-A C201-B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	FIRE EXIT HARDWARE	98-EO-F		626	VON
1	EA	SURFACE CLOSER	4040XP DE		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MAGNETIC DOOR HOLDER	SEM7850 12V/24V/120V		✎ 689	LCN
1	EA	GASKETING	488SBK PSA		BK	ZER

CONNECT MAGNETIC DOOR HOLDER TO FIRE ALARM SYSTEM

OPERATIONS:

DOOR IS NORMALLY HELD OPEN BY MAGNETIC DOOR HOLDER
DOOR IS LATCHED AND CLOSED UPON LOSS OF POWER TO THE MAGNETIC DOOR HOLDER

HARDWARE GROUP NO. 05

For use on Door #(s):

10.210A 10.210B-B 10.210C 10.210E 10.210NN

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-03		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6111 FSE 12/24 VAC/VDC	⚡	630	VON
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.	⚡		

DOOR IS SECURED IN AN EMERGENCY. NO STAIR REENTRY IS PROVIDED BY HARDWARE.
 OBTAIN PERMISSION FROM BUILDING OFFICIALS FOR USING FAIL SECURE ELECTRIC STRIKE
 AT FIRE RATED STAIR DOORS

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON ACTIVATION OF FIRE ALARM SYSTEM, OR LOSS OF POWER TO THE
 STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 07

For use on Door #(s):

C101-A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
2	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	FIXED CENTER MULLION	BY DOOR/FRAME MANUFACTURER			
1	EA	DELAYED PANIC HARDWARE	CX98-EO 24 VDC		⚡ 626	VON
1	EA	DELAYED PANIC HARDWARE	CX98-L-E996-03-FSE-CON 24 VDC		⚡ 626	VON
2	EA	SFIC MORTISE CYL. HOUSING	80-102 (RING & CAM AS REQ'D) (FOR DELAYED EGRESS)		626	SCH
1	EA	SFIC RIM HOUSING	80-129		626	SCH
3	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
2	EA	SURFACE CLOSER	4050A EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS401/402CVX		626	IVE
2	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
2	EA	WIRE HARNESS (HINGE TO POWER SUPPLY)	CON-192P		⚡	SCH
2	EA	WIRE HARNESS (HINGE TO HARDWARE)	CON-XX (AS REQUIRED)		⚡	SCH
2	EA	CREDENTIAL READER	BY DIVISION 28.		⚡	
1	EA	EXTERNAL ALARM	BY ALARM CONTRACTOR		⚡	
1	EA	FIRE ALARM CONTACT	BY FIRE ALARM CONTRACTOR.		⚡	
1	EA	POWER SUPPLY	PS904 900-2RS 120/240 VAC		⚡ LGR	SCE

CONNECT DELAYED EGRESS DEVICE TO FIRE ALARM OR EMERGENCY SYSTEM

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL FROM INGRESS SIDE TEMPORARILY RELEASES LEVER FOR ENTRY
 PRESENTING VALID CREDNETIAL FROM EGRESS SIDE TEMPORARILY DISARMS ALARM AND RELEASES DELAYED EGRESS FOR IMMEDIATE EXIT
 PUSHING DELAYED EGRESS DEVICE UNTIL THE LOCAL ALARM SOUNDS, REMOTE ALARM SOUNDS AND DOOR CAN BE UNLOCKED IN 15 SECONDS. MANUALLY RESET LOCAL ALARM
 DOOR IS SECURED AT INGRESS SIDE UPON ACTIVATION OF FIRE ALARM OR EMERGENCY SYSTEM, OR LOSS OF POWER TO THE DEVICE
 DOOR IS FOR IMMEDIATE EGRESS UPON ACTIVATION OF FIRE ALARM OR EMERGENCY SYSTEM, OR LOSS OF POWER TO THE DEVICE

HARDWARE GROUP NO. 08

For use on Door #(s):

1.203A	2.601A	2.601B	2.601C	2.601D	2.601E
3.301	10.305C	D301	D302		

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	⚡	630	VON
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.	⚡		

DOOR #2.306C REMOVED, NO LONGER PART OF THE PROJECT

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 08A

For use on Door #(s):

1.202

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	⚡	630	VON
1	EA	SURFACE CLOSER	4050A H		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.	⚡		

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 08B

For use on Door #(s):

1.201 2.306A 2.306B 2.406A 2.406B 5.103

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 10

For use on Door #(s):

5.101-B	C101	C105-A	C201A-A	C205-A	C206
D401	D601-A	D602	D604-B		

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	⚡	630	VON
1	EA	SURFACE CLOSER	4050A EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.	⚡		

REPLACED PANIC DEVICE WITH STOREROOM LOCK PER REVIEW 02.13.2023

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 12B

For use on Door #(s):

5.201	5.201A	5.202	6.105-A	6.105-B	6.106-A
6.106-B					

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

CHANGED STOREROOM LOCK TO CLASSROOM PER REVIEW 02.13.2023.
 REMOVED CARD READER AT #5.201, #5.201A, #5.202, PER OWNER'S COMMENTS 04.12.2023
 PROVIDE HINGE WITH NO "NRP" AT #6.105-A

HARDWARE GROUP NO. 12C

For use on Door #(s):

ST101-A ST101-C

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

CHANGED STOREROOM LOCK TO CLASSROOM PER REVIEW 02.13.2023.
 REMOVED CARD READER, REPLACED CLASSROOM WITH STOREROOM LOCK AT #ST101-A,
 #ST101-C PER OWNER'S COMMENTS 04.12.2023

HARDWARE GROUP NO. 13

For use on Door #(s):

6.204

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	⚡	630	VON
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.	⚡		

CHANGED STOREROOM LOCK TO CLASSROOM PER REVIEW 02.13.2023

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE LEVER FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 14

For use on Door #(s):

6.108 6.109 6.206

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

REMOVED CARD READER AT #6.108, #6.109, #6.206

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 14A

For use on Door #(s):

3.201A 3.201B 3.201C 3.201D 3.201E 3.201F
 5.903

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	⚡	630	VON
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.			
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.			

ADDED CLOSER AT #3.201A, #3.201B, 3.201C, 3.201D, 3.201E, 3.201F PER OWNER'S COMMENTS
 04.12.2023

OPERATIONS:





DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 14B

For use on Door #(s):

3.902 5.907

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER







REMOVED CARD READER, AND REPLACED STOREROOM WITH ENTRY LOCK AT #3.902 PER OWNER'S COMMENTS 04.12.2023

HARDWARE GROUP NO. 16.1

For use on Door #(s):

10.305A-A 10.305A-B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER







REMOVED CARD READER AT #10.305A-A, #10.305A-B PER OWNER'S COMMENTS 04.12.2023

HARDWARE GROUP NO. 17

For use on Door #(s):

2.205B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
2	EA	MANUAL FLUSH BOLT	FB358		626	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED		626	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
2	EA	WALL STOP	WS401/402CVX		626	IVE
2	EA	SILENCER	SR64		GRY	IVE










REPLACED OH STOP WITH WALL STOP PER REVIEW 02.13.2023

HARDWARE GROUP NO. 18

For use on Door #(s):

ST101-B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
2	EA	MANUAL FLUSH BOLT	FB457		626	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED		626	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	ASTRAGAL	43STST		STST	ZER
2	EA	SILENCER	SR64		GRY	IVE







VERIFY IF CARD READER IS REQUIRED. HARDWARE IS FOR CARD ACCESS
 REMOVED CARD READER AT #ST101-B PER OWNER'S COMMENTS 04.12.2023

HARDWARE GROUP NO. 20

For use on Door #(s):

C007

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER








REMOVED CARD READER AT #C007 PER OWNER'S COMMENTS 04.12.2023

HARDWARE GROUP NO. 21

For use on Door #(s):

1.107A 1.107B 1.107C 1.107D 1.107E 1.107F
 1.107G 1.107H 2.902A 2.902B 2.902C 4.107A
 4.107B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PUSH PLATE	8200 6" X 16"		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"		630	IVE
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER







DOOR IS NOT LATCHED AND OPENED/CLOSED BY PUSH/PULL PLATE.

HARDWARE GROUP NO. 22

For use on Door #(s):

1.203B	1.306	2.603A1	2.603A2	2.603B1	2.603B2
2.603C1	2.603C2	2.603D1	2.603D2	2.603E1	2.603E2
2.902D	6.902A	6.902B	10.209A	10.209B	

Provide each door(s) with the following:





QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK	L9040 03A L583-363 L283-722		626	SCH
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 23

For use on Door #(s):

3.102A	3.102B	3.102C	3.102D	3.202A	3.202B
3.202C	3.202D	3.202E	3.202F	3.302	

Provide each door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PRIVACY LOCK	L9040 03A L583-363 L283-722		626	SCH
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 24

For use on Door #(s):

2.901	3.901A	4.105	5.104	5.203	5.906
6.106	10.205	10.303			

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER







CHANGED LOCK FUNCTION FROM PASSAGE TO CLASSROOM PER REVIEW 02.13.2023
CHANGED LOCK FUNCTION FROM CLASSROOM TO ENTRY LOCK AT #3.903, #3.904A, #3.904B
AND REASSIGNED TO HARDWARE SET #46A, 04.24.2023

HARDWARE GROUP NO. 24.1

For use on Door #(s):

10.203

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A H		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER







CHANGED LOCK FUNCTION FROM PASSAGE TO CLASSROOM PER REVIEW 02.13.2023
 REPLACED REGULAR CLOSER ARM WITH HOLD-OPEN ARM AT #10.203 PER OWNER'S
 COMMENTS 04.12.2023

HARDWARE GROUP NO. 24.2

For use on Door #(s):

10.202

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A HEDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER







CHANGED LOCK FUNCTION FROM PASSAGE TO CLASSROOM PER REVIEW 02.13.2023
 REPLACED REGULAR CLOSER ARM WITH HOLD-OPEN ARM AT #10.202, PER OWNER'S
 COMMENTS 04.12.2023

HARDWARE GROUP NO. 24A

For use on Door #(s):

2.103A	2.103B	2.203A1	2.203A2	2.203B1	2.203B2
2.203C1	2.203C2	2.303A1	2.303A2	2.303B1	2.303B2
2.303C1	2.303C2	2.303D1	2.303D2	2.403A1	2.403A2

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S TLR		626	SCH
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER





REVISED PRIVACY TO PASSAGE SET PER REVIEW 02.13.2023

HARDWARE GROUP NO. 25

For use on Door #(s):

2.602A	2.602B	2.602C	2.602D	2.602E
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Provide each door(s) with the following:




QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S TLR		626	SCH
1	EA	OH STOP	90S J		630	GLY
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 26

For use on Door #(s):

2.605A	2.605B	2.605C	2.605D	2.605E	2.606A
2.606B	2.606C	2.606D	2.606E		

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S TLR		626	SCH
3	EA	SILENCER	SR64		GRY	IVE





PROVIDE OVERHEAD STOP IF WALL STOP CAN'T BE INSTALLED
 REMOVED WALL STOP PER OWNER'S COMMENTS 04.12.2023

HARDWARE GROUP NO. 27

For use on Door #(s):

5.105A 5.105B 5.105C 5.105D 5.105E

Provide each door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	PASSAGE SET	ND10S TLR		626	SCH
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 28

For use on Door #(s):

4.101-A 4.101-B 5.101-A 6.101A-A 6.101B-A 6.101B-B
 D601A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

REPLACED PANIC DEVICE WITH CLASSROOM LOCK, AND REMOVED CLOSER PER REVIEW
 02.13.2023

ADDED CLOSER PER OWNER'S COMMENTS 04.12.2023






PROVIDE HINGES WITH NON-REMOVABLE PIN AT OUTSWING DOORS WITH KEYED LOCK

HARDWARE GROUP NO. 32

For use on Door #(s):

2.102-B 2.202A-B 2.202B-B 2.202C-B 2.302A-B 2.302B-B
 2.302C-B 2.302D-B 2.402A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
2	EA	PANIC HARDWARE	9827-L-LBR-03		626	VON
2	EA	SFIC RIM HOUSING	80-129		626	SCH
2	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
2	EA	SURFACE CLOSER	4050A CUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

RELOCATED DOOR #2.402A FROM SET #33 TO #32 PER OWNER'S COMMENTS 04.12.2023







OPERATIONS:
 MECHANICAL KEY LOCKS AND UNLOCKS LEVER TRIM
 FLAT KEY DOGS DOOR AS NEEDED

HARDWARE GROUP NO. 33

For use on Door #(s):

2.102-A 2.202A-A 2.202B-A 2.202C-A 2.302A-A 2.302B-A
 2.302C-A 2.302D-A

Provide each door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
2	EA	PUSH PLATE	8200 6" X 16"		630	IVE
2	EA	LONG DOOR PULL	9266F 72" 56" O		630-316	IVE
2	EA	SURFACE CLOSER	4050A CUSH		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 33A

For use on Door #(s):

2.402B 2.404A-B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	98-L-03		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER






OPERATIONS:
 MECHANICAL KEY LOCKS AND UNLOCKS LEVER TRIM
 FLAT KEY DOGS DOOR AS NEEDED

HARDWARE GROUP NO. 33B

For use on Door #(s):

4.103-A 4.103-B

Provide each door(s) with the following:









QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	98-L-03		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 35

For use on Door #(s):

10.206A

Provide each door(s) with the following:









QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
2	EA	MANUAL FLUSH BOLT	FB457		626	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED		626	IVE
1	EA	STOREROOM LOCK	ND80BD TLR 14-042		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS		630	IVE
2	EA	WALL STOP	WS401/402CVX		626	IVE
2	EA	SILENCER	SR64		GRY	IVE

HARDWARE GROUP NO. 35A

For use on Door #(s):

10.102

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	FIXED CENTER MULLION	BY DOOR/FRAME MANUFACTURER			
1	EA	PANIC HARDWARE	98-EO		626	VON
1	EA	PANIC HARDWARE	98-L-NL-03		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
2	EA	SURFACE CLOSER	4050A EDA		689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
2	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	MULLION SEAL	8780NBK PSA		BK	ZER
2	EA	SILENCER	SR64		GRY	IVE

INSTALL HARDWARE FOR 180-DEGREE DOOR SWING
 DOOR IS CONFIRMED OUTSWING. VERIFY IF PANIC DEVICE IS REQUIRED AT #10.102.
 ADDED PANIC DEVICE AT #10.102 04.24.2023

HARDWARE GROUP NO. 36

For use on Door #(s):

2.104-B 2.304D-B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	DELAYED PANIC HARDWARE	CX98-L-E996-03-FSE-CON 24 VDC		⚡ 626	VON
1	EA	SFIC MORTISE CYL. HOUSING	80-102 (RING & CAM AS REQ'D)		626	SCH
1	EA	SFIC RIM HOUSING	80-129		626	SCH
2	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	WIRE HARNESS (HINGE TO POWER SUPPLY)	CON-192P		⚡	SCH
1	EA	WIRE HARNESS (HINGE TO HARDWARE)	CON-XX (AS REQUIRED)		⚡	SCH
2	EA	CREDENTIAL READER	BY DIVISION 28.		⚡	
1	EA	EXTERNAL ALARM	BY ALARM CONTRACTOR		⚡	
1	EA	FIRE ALARM CONTACT	BY FIRE ALARM CONTRACTOR.		⚡	
1	EA	POWER SUPPLY	PS904 120/240 VAC		⚡ LGR	SCE

USE CLOSER SPRING CUSH ARM TO STOP DOOR
 ADDED TWO CARD READERS, DELAYED EGRESS AT #2.104-B PER OWNER'S COMMENTS
 04.12.2023
 PROVIDE CLOSER #4050A WITH EDA ARM WITH WALL STOP AT #2.304D-B

OPERATIONS:
 DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL FROM INGRESS SIDE TEMPORARILY RELEASES LEVER FOR ENTRY
 PRESENTING VALID CREDNETIAL FROM EGRESS SIDE TEMPORARILY DISARMS ALARM AND RELEASES DELAYED EGRESS FOR IMMEDIATE EXIT
 PUSHING DELAYED EGRESS DEVICE UNTIL THE LOCAL ALARM SOUNDS, REMOTE ALARM SOUNDS AND DOOR CAN BE UNLOCKED IN 15 SECONDS. MANUALLY RESET LOCAL ALARM
 DOOR IS SECURED AT INGRESS SIDE UPON ACTIVATION OF FIRE ALARM OR EMERGENCY SYSTEM, OR LOSS OF POWER TO THE DEVICE
 DOOR IS FOR IMMEDIATE EGRESS UPON ACTIVATION OF FIRE ALARM OR EMERGENCY SYSTEM, OR LOSS OF POWER TO THE DEVICE

HARDWARE GROUP NO. 37

For use on Door #(s):

2.404B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	⚡	630	VON
1	EA	SURFACE CLOSER	4050A EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.	⚡		

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 37A

For use on Door #(s):

2.404A-A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC	⚡	630	VON
1	EA	SURFACE CLOSER	4050A CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.	⚡		

REMOVED WALL STOP AND REPLACED CLOSER WITH CUSH ARM PER OWNER'S COMMENTS
 04.12.2023

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 37B

For use on Door #(s):

2.104-A	2.204A-A	2.204A-B	2.204B-A	2.204B-B	2.204C-A
2.204C-B	2.304A-A	2.304A-B	2.304B-A	2.304B-B	2.304C-A
2.304C-B	2.304D-A				

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	INSTITUTION LOCK	ND82BD RHO TLR		626	SCH
2	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE 12/16/24/28 VAC/VDC		⚡ 630	VON
1	EA	SURFACE CLOSER	4050A EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
2	EA	CREDENTIAL READER	BY DIVISION 28.		⚡	
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.		⚡	

MOUNT HARDWARE FOR 180-DEGREE DOOR SWING AT OPENING #2.204C-A, #2.204B-B, #2.304B-B, #2.304C-A

REMOVED DELAYED EGRESS DEVICE AND REPLACED WITH INSTITUTIONAL LOCK AND ELEC. STRIKE 06.14.2023

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED AT BOTH SIDES OF THE DOOR PRESENTING VALID CREDENTIAL FROM EITHER SIDE OF THE DOOR TEMPORARILY RELEASES STRIKE FOR ENTRY OR EXIT
 DOOR IS SECURED AT BOTH SIDES UPON LOSS OF POWER TO THE STRIKE

HARDWARE GROUP NO. 40

For use on Door #(s):

4.104	4.201	4.203	5.106	5.107	5.904
6.203	6.205	10.302			

Provide each door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	CLASSROOM LOCK	ND70BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 41

For use on Door #(s):

1.107	10.103B	10.104A	10.104B	10.104C	10.105
10.106	10.206B	10.206C	10.206D	10.304	10.305B
M101					

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	STOREROOM LOCK	ND80BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE







PROVIDE 4050A-CUSH CLOSER AND OMIT WALL STOP AT #10.206B, #10.206D

HARDWARE GROUP NO. 41A

For use on Door #(s):

2.204A-D	2.204B-D	2.204C-D	2.205A-B	2.301A	2.304A-D
2.304B-D	2.304C-D	2.307A-B	10.103A	10.103C	2.307A-A
2.205A-A					

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	98-L-NL-03		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE







DOOR #10.103A, #10.103C SWING OUT. ADDED PANIC DEVICE 04.24.2023

HARDWARE GROUP NO. 42

For use on Door #(s):

2.506A1 2.506B1 2.506C1 2.506D1

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	CLASSROOM LOCK	ND70BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CCV		626	IVE
3	EA	SILENCER	SR64		GRY	IVE





CHANGED LOCK FUNCTION FROM STOREROOM TO CLASSROOM PER REVIEW 02.13.2023
 SECURITY PLAN CALLS PASSAGE LOCK AT 383. VERIFY LOCK FUNCTION

HARDWARE GROUP NO. 44

For use on Door #(s):

3.101A 3.101B 3.101C 3.101D

Provide each door(s) with the following:






QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	WALL STOP	WS401/402CCV		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

HARDWARE GROUP NO. 46

For use on Door #(s):

10.207 10.208

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER







CHANGED CORRIDOR LOCK TO CLASSROOM PER REVIEW 02.13.2023
 SECURITY PLAN CALLS PASSAGE LOCK AT 383. VERIFY LOCK FUNCTION
 REPLACED CLASSROOM WITH ENTRY LOCK PER OWNER'S COMMENTS 04.12.2023

HARDWARE GROUP NO. 46A

For use on Door #(s):

3.903 3.904A 3.904B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5		652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER

REPLACED CLASSROOM WITH ENTRY LOCK PER OWNER'S COMMENTS 04.12.2023

HARDWARE GROUP NO. 49

For use on Door #(s):

1.302A	1.302B	1.303A	1.303B	1.304	2.104-C
2.204A-C	2.204B-C	2.204C-C	2.304A-C	2.304B-C	2.304C-C
2.304D-C	2.501A	2.501B	2.501C	2.501D	2.502A
2.502B	2.502C	2.502D	2.503A-A	2.503A-B	2.503B-A
2.503B-B	2.503C-A	2.503C-B	2.503D-A	2.503D-B	2.506A2
2.506B2	2.506C2	2.506D2	10.210D	C001	C002
C003	C004-A	C004-B	C005	C006	C107
MR101	MR103				

Provide each door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	NOTE	HARDWARE BY DIV. 11 AND/OR DEV. 08 (SEE SHEET A75.4 FOR MORE INFORMATION)		

HARDWARE GROUP NO. 101

For use on Door #(s):

6.906	D603
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Provide each door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3 EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1 EA	FIRE EXIT HARDWARE	98-L-NL-F-03	626	VON
1 EA	SFIC RIM HOUSING	80-129	626	SCH
1 EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST	626	BES
1 EA	SURFACE CLOSER	4040XP EDA	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1 EA	MAGNETIC DOOR HOLDER	SEM7850 12V/24V/120V	689	LCN
1 EA	GASKETING	488SBK PSA	BK	ZER

VERIFY DOOR MATERIAL OF #6.906, D603 FOR 180MINS RATED OPENING
 CONNECT MAGNETIC DOOR HOLDER TO FIRE ALARM SYSTEM
 INSTALL HARDWARE FOR 180-DEGREE DOOR SWING AT #6.906
 PROVIDE WIDE THROW HINGES AS REQUIRED TO ALLOW DOOR TO SWING 180 DEGREES AT #6.906
 REMOVED CARD READER, DOOR CONTACT AT #6.906, #D603 PER OWNER'S COMMENTS
 04.12.2023

OPERATIONS:







DOOR IS NORMALLY HELD OPEN BY THE MAGNETIC DOOR HOLDER
 DOOR IS LATCHED AND SECURED UPON LOSS OF POWER TO THE MAGNETIC DOOR HOLDER
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 101A

For use on Door #(s):

D601-B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP		652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-03		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	MAGNETIC DOOR HOLDER	SEM7850 12V/24V/120V	 ⚡	689	LCN
1	EA	GASKETING	488SBK PSA		BK	ZER

VERIFY DOOR MATERIAL OF #D601-B FOR 180MINS RATED OPENING
CONNECT MAGNETIC DOOR HOLDER TO FIRE ALARM SYSTEM
REMOVED CARD READER, DOOR CONTACT PER OWNER'S COMMENTS 04.12.2023

OPERATIONS:







DOOR IS NORMALLY HELD OPEN BY MAGNETIC DOOR HOLDER
DOOR IS LATCHED AND SECURED UPON LOSS OF POWER TO THE MANETIC DOOR HOLDER
FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 102

For use on Door #(s):

D604-A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-03		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6111 FSE 12/24 VAC/VDC	 ⚡	630	VON
1	EA	SURFACE CLOSER	4040XP CUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.	⚡		
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.	⚡		

VERIFY DOOR MATERIAL OF #D604-A FOR 180MINS RATED OPENING
REMOVED DOOR CONTACT PER OWNER'S COMMENTS 04.12.2023

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
DOOR IS LATCHED AND SECURED UPON LOSS OF POWER TO THE STRIKE
FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 110

For use on Door #(s):

10.210B-A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	PANIC HARDWARE	LD-98-NL-990/697PULL		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6111 FSE 12/24 VAC/VDC		⚡ 630	VON
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS18L		BLK	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429 @ HEAD & JAMBS		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A -OR AS REQUIRED BY SILL DETAIL		A	ZER
1	EA	CREDENTIAL READER	BY DIVISION 28.		⚡	
1	EA	DOOR CONTACT	679-05HM		⚡ BLK	SCE
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.		⚡	

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 DOOR IS MONITORED THROUGH ACCESS CONTROL OR SECURITY SYSTEM
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. 111

For use on Door #(s):

10.210F

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	POWER TRANSFER	EPT10 CON		⚡ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-98-EO-ALK-CON 9-VOLT BATTERY WITH HARDWIRED OPTION		⚡ 626	VON
1	EA	SFIC MORTISE CYL. HOUSING	80-102 (RING & CAM AS REQ'D) (FOR ALARM)		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS18L		BLK	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429 @ HEAD & JAMBS		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A -OR AS REQUIRED BY SILL DETAIL		A	ZER
1	EA	WIRE HARNESS (HINGE TO POWER SUPPLY)	CON-192P		⚡	SCH
1	EA	WIRE HARNESS (HINGE TO HARDWARE)	CON-XX (AS REQUIRED)		⚡	SCH
1	EA	EXTERNAL ALARM	BY ALARM CONTRACTOR		⚡	
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.		⚡	

OPERATIONS:







PUSHING DEVICE SOUNDS LOCAL AND EXTERNAL ALARM; MANUALLY RESET LOCAL ALARM

HARDWARE GROUP NO. 112

For use on Door #(s):

10.210G

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		630	IVE
1	EA	CLASSROOM LOCK	ND70BD TLR		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429 @ HEAD & JAMBS		AA	ZER








PROVIDE GASKETING AT FOUR SIDES OF THE OPENING
 COORDINATE WITH WOOD DOOR MANUFACTURER TO PROVIDE FIRE RATED DOOR WITH
 INTUMESCENT SEAL PER FIRE CODE

HARDWARE GROUP NO. 121

For use on Door #(s):

C102-C

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP SEC		630	IVE
2	EA	DBL CYL DEADBOLT	B662BD		626	SCH
4	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	PUSH PLATE	8200 6" X 16" TORX		630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16" TORX		630	IVE
1	SET	GASKETING	429AA-S @ HEAD & JAMBS		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	655A -OR AS REQUIRED BY SILL DETAIL		A	ZER

VERIFY OPENING FIRE RATING. HARDWARE IS FOR NON-RATED DOOR
 EMERGENCY ACCESS TO SECURED INMATE YARD ONLY
 INSTALL TWO DEADBOLTS ONE HIGH AND ONE LOW

HARDWARE GROUP NO. 130

For use on Door #(s):

C205

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	5BB1HW 4.5 X 4.5 NRP		652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 4.5 X 4.5 CON TW8		⚡ 652	IVE
1	EA	ELEC FIRE EXIT HARDWARE	RX-98-L-NL-F-03-ALK-CON 9- VOLT BATTERY WITH HARDWIRED OPTION		⚡ 626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	ELECTRIC STRIKE	6111 FSE 12/24 VAC/VDC		⚡ 630	VON
1	EA	SURFACE CLOSER	4050A RW/PA		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE
1	EA	GASKETING	488SBK PSA		BK	ZER
1	EA	WIRE HARNESS (HINGE TO POWER SUPPLY)	CON-192P		⚡	SCH
1	EA	WIRE HARNESS (HINGE TO HARDWARE)	CON-XX (AS REQUIRED)		⚡	SCH
2	EA	CREDENTIAL READER	BY DIVISION 28.		⚡	
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.		⚡	

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL AT STAIR SIDE TEMPORARILY RELEASES STRIKE FOR ENTRY
 PRESENTING VALID CREDENTIAL AT PUSH SIDE TEMPORARILY DISARMS ALARM FOR EXIT
 ALARM SOUNDS IF DOOR IS OPENED WITHOUT PRESENTING VALID CREDENTIAL, AND SEND
 SIGNAL TO SECURITY PANEL.
 DOOR IS SECURED UPON ACTIVATION OF FIRE ALARM SYSTEM, OR LOSS OF POWER TO THE
 STRIKE

HARDWARE GROUP NO. A01

For use on Door #(s):

1.101-A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	SET	HANGING DEVICE	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	EA	FIXED CENTER MULLION	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	EA	PANIC HARDWARE	98-EO		626	VON
1	EA	PANIC HARDWARE	98-NL-OP-110MD		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
2	EA	ELECTRIC STRIKE	6300 FSE 12/24 VAC/VDC		⚡ 630	VON
2	EA	LONG DOOR PULL	9264F 72" O		630	IVE
1	EA	SURFACE CLOSER	4040XP EDAW/62G		689	LCN
1	EA	SURF. AUTO OPERATOR	4642 CS TBWMS 120 VAC		⚡ 689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA (AS REQ'D)		689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT		689	LCN
1	EA	ACTUATOR KIT	8310-3853TWF		⚡ 630	LCN
1	EA	RECEIVER	8310-865		⚡	LCN
2	EA	FLOOR STOP	FS18L		BLK	IVE
1	SET	WEATHER STRIPPING	BY ALUMINUM DOOR/FRAME MANUFACTURER			
2	EA	DOOR SWEEP	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
2	EA	THRESHOLD	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
1	EA	CREDENTIAL READER	BY DIVISION 28.		⚡	
2	EA	DOOR CONTACT	7764		⚡ 628	SCE
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.		⚡	

PROVIDE OVERHEAD STOP IF FLOOR STOP CAN'T BE INSTALLED

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES STRIKE FOR ENTRY
 WIRELESS ACTUATOR AT VESTIBULE SIDE IS ALWAYS ACTIVE
 DOOR IS MONITORED THROUGH ACCESS CONTROL OR SECURITY SYSTEM
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. A01A

For use on Door #(s):

1.101-B

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	SET	HANGING DEVICE	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	EA	FIXED CENTER MULLION	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	EA	PANIC HARDWARE	98-EO		626	VON
1	EA	PANIC HARDWARE	98-NL-OP-110MD		626	VON
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
2	EA	ELECTRIC STRIKE	6300 FSE 12/24 VAC/VDC		⚡ 630	VON
2	EA	LONG DOOR PULL	9264F 72" O		630	IVE
1	EA	SURFACE CLOSER	4040XP ED AW/62G		689	LCN
1	EA	SURF. AUTO OPERATOR	4642 CS TBWMS 120 VAC		⚡ 689	LCN
1	EA	PA MOUNTING PLATE	4040XP-18PA (AS REQ'D)		689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 SRT		689	LCN
2	EA	ACTUATOR KIT	8310-3853TWF		⚡ 630	LCN
1	EA	RECEIVER	8310-865		⚡	LCN
2	EA	BOLLARD PART	8310-866			LCN
2	EA	FLOOR STOP	FS18L		BLK	IVE
1	SET	WEATHER STRIPPING	BY ALUMINUM DOOR/FRAME MANUFACTURER			
2	EA	DOOR SWEEP	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
2	EA	THRESHOLD	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
1	EA	CREDENTIAL READER	BY DIVISION 28.		⚡	
2	EA	DOOR CONTACT	7764		⚡ 628	SCE
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.		⚡	

PROVIDE OVERHEAD STOP IF FLOOR STOP CAN'T BE INSTALLED

OPERATIONS:











DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL TEMPORARILY RELEASES DEVICE FOR ENTRY
 EXTERIOR ADA ACTUATOR IS TURNED ON/OFF THROUGH ACCESS CONTROL SYSTEM;
 INTERIOR ACTUATOR IS ALWAYS ACTIVE
 DOOR IS MONITORED THROUGH ACCESS CONTROL OR SECURITY SYSTEM
 DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE
 FREE EGRESS AT ALL TIMES

HARDWARE GROUP NO. A02

For use on Door #(s):

D402

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	SET	HANGING DEVICE	BY ALUMINUM DOOR/FRAME MANUFACTURER			
2	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	FIXED CENTER MULLION	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	EA	ELEC PANIC HARDWARE	RX-98-EO-ALK-CON 9-VOLT BATTERY WITH HARDWIRED OPTION		626	VON
1	EA	ELEC PANIC HARDWARE	RX-98-NL-OP-110MD-ALK-CON 9-VOLT BATTERY WITH HARDWIRED OPTION		626	VON
2	EA	SFIC MORTISE CYL. HOUSING	80-102 (RING & CAM AS REQ'D)		626	SCH
1	EA	SFIC RIM HOUSING	80-129		626	SCH
3	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
2	EA	ELECTRIC STRIKE	6300 FSE 12/24 VAC/VDC		630	VON
2	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
2	EA	SURFACE CLOSER	4040XP EDAW/62G		689	LCN
2	EA	PA MOUNTING PLATE	4040XP-18PA (AS REQ'D)		689	LCN
2	EA	CUSH SHOE SUPPORT	4040XP-30 SRT		689	LCN
2	EA	FLOOR STOP	FS18L		BLK	IVE
1	SET	WEATHER STRIPPING	BY ALUMINUM DOOR/FRAME MANUFACTURER			
2	EA	DOOR SWEEP	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
2	EA	THRESHOLD	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
2	EA	WIRE HARNESS (HINGE TO POWER SUPPLY)	CON-192P			SCH
2	EA	WIRE HARNESS (HINGE TO HARDWARE)	CON-XX (AS REQUIRED)			SCH
2	EA	CREDENTIAL READER	BY DIVISION 28.			
2	EA	DOOR CONTACT	7764		628	SCE
1	EA	LOW VOLTAGE POWER	BY DIVISION 28.			

PROVIDE OVERHEAD STOP IF FLOOR STOP CAN'T BE INSTALLED
 ADDED TWO CARD READERS AT #D402 PER OWNER'S COMMENTS. ADDED ALARM KITS TO THE PANIC DEVICES

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED

PRESENTING VALID CREDENTIAL FROM INGRESS SIDE TEMPORARILY RELEASES STRIKE FOR ENTRY

PRESENTING VALID CREDENTIAL FROM EGRESS SIDE TEMPORARILY DISARMS THE ALARM FOR EXIT

ALARM SOUNDS WITHOUT PRESENTING VALID CREDENTIAL FROM EGRESS SIDE; MANUALLY RESETS ALARM

DOOR IS MONITORED THROUGH ACCESS CONTROL OR SECURITY SYSTEM


DOOR IS SECURED UPON LOSS OF POWER TO THE STRIKE

HARDWARE GROUP NO. A03

For use on Door #(s):

C106

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	SET	HANGING DEVICE	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	ELEC PANIC HARDWARE	RX-98-NL-OP-110MD-ALK-CON		626	VON
			9-VOLT BATTERY WITH HARDWIRED OPTION			
1	EA	SFIC RIM HOUSING	80-129		626	SCH
1	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
1	EA	CLOSER/STOP	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	EA	WEATHERSTRIPPING	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
1	EA	DOOR SWEEP	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
1	EA	THRESHOLD	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
1	EA	WIRE HARNESS (HINGE TO POWER SUPPLY)	CON-192P			SCH
1	EA	WIRE HARNESS (HINGE TO HARDWARE)	CON-XX (AS REQUIRED)			SCH
1	EA	DOOR CONTACT	7764		628	SCE
1	EA	EXTERNAL ALARM	BY ALARM CONTRACTOR			
1	EA	POWER SUPPLY	PS900 SERIES 120/240VAC			VON

HARDWARE IS FOR AL/GL DOOR PER REVIEW
 CONNECT DOOR CONTACT TO EXTERNAL ALARM SYSTEM

OPERATIONS:



LOCAL AND EXTERNAL ALARM SOUNDS WHEN DOOR IS OPENED, AND SECURITY WILL BE NOTIFIED
 DOOR IS MONITORED THROUGH ACCESS CONTROL OR SECURITY SYSTEM
 EMERGENCY EXIT ONLY

HARDWARE GROUP NO. A03A

For use on Door #(s):

1.103

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	SET	HANGING DEVICE	BY ALUMINUM DOOR/FRAME MANUFACTURER			
2	EA	DUMMY PUSH BAR	350		626	VON
2	EA	LONG DOOR PULL	9264F 72" O		630	IVE
2	EA	OH STOP	100S ADJ		630	GLY
1	EA	CLOSER/STOP	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	EA	SURF. AUTO OPERATOR	4642 CS TBWMS 120 VAC		↗ 689	LCN
1	EA	ACTUATOR KIT	8310-3818TWF		↗ 630	LCN
1	EA	ACTUATOR KIT	8310-3853TWF		↗ 630	LCN
1	EA	RECEIVER	8310-865		↗	LCN
1	SET	WEATHER STRIPPING	BY ALUMINUM DOOR/FRAME MANUFACTURER			
2	EA	DOOR SWEEP	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
2	EA	THRESHOLD	BY ALUMINUM DOOR/FRAME MANUFACTURER.			

OPERATIONS:








WIRELESS ACTUATOR AT EITHER SIDE OF THE DOOR ACTIVATES THE OPERATOR

HARDWARE GROUP NO. A04

For use on Door #(s):

C100

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	SET	HANGING DEVICE	BY ALUMINUM DOOR/FRAME MANUFACTURER			
2	EA	POWER TRANSFER	EPT10 CON		689	VON
1	EA	FIXED CENTER MULLION	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	EA	ELEC PANIC HARDWARE	RX-98-EO-ALK 9-VOLT BATTERY WITH HARDWIRED OPTION		626	VON
1	EA	ELEC PANIC HARDWARE	RX-98-NL-OP-110MD-ALK-CON 9-VOLT BATTERY WITH HARDWIRED OPTION		626	VON
2	EA	SFIC MORTISE CYL. HOUSING	80-102 (RING & CAM AS REQ'D)		626	SCH
1	EA	SFIC RIM HOUSING	80-129		626	SCH
3	EA	PERMANENT SFIC CORE	BEST SFIC PER OWNER'S REQUEST		626	BES
2	EA	ELECTRIC STRIKE	6300 FSE 12/24 VAC/VDC		630	VON
2	EA	90 DEG OFFSET PULL	8190EZHD 10" O		630-316	IVE
2	EA	OH STOP	100S ADJ		630	GLY
2	EA	CLOSER/STOP	BY ALUMINUM DOOR/FRAME MANUFACTURER			
1	SET	WEATHER STRIPPING	BY ALUMINUM DOOR/FRAME MANUFACTURER			
2	EA	DOOR SWEEP	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
2	EA	THRESHOLD	BY ALUMINUM DOOR/FRAME MANUFACTURER.			
2	EA	WIRE HARNESS (HINGE TO POWER SUPPLY)	CON-192P			SCH
2	EA	WIRE HARNESS (HINGE TO HARDWARE)	CON-XX (AS REQUIRED)			SCH
2	EA	CREDENTIAL READER	BY DIVISION 28.			
1	EA	EXTERNAL ALARM	BY ALARM CONTRACTOR			
1	EA	FIRE ALARM CONTACT	BY FIRE ALARM CONTRACTOR.			
1	EA	REMOTE RELEASE BUTTON	BY DIVISION 28.			
1	EA	POWER SUPPLY	PS900 SERIES 120/240VAC			VON

CONNECT ALARM DEVICE TO THE FIRE OR EMERGENCY SYSTEM

OPERATIONS:

DOOR IS NORMALLY LATCHED AND SECURED
 PRESENTING VALID CREDENTIAL FROM INGRESS SIDE, OR PUSHING RELEASE BUTTON FROM SECURITY TEMPORARILY RELEASES STRIKE FOR ENTRY
 PRESENTING VALID CREDNETIAL FROM EGRESS SIDE TEMPORARILY DISARMS ALARM FOR EXIT
 PUSHING DEVICE WITHOUT CREDENTIAL SOUNDS THE LOCAL, AND REMOTE ALARM AT SECURITY. MANUALLY RESET LOCAL ALARM
 DOOR IS SECURED AT INGRESS SIDE UPON ACTIVATION OF FIRE ALARM OR EMERGENCY SYSTEM, OR LOSS OF POWER TO THE STRIKE
 DOOR IS FOR IMMEDIATE EGRESS UPON ACTIVATION OF FIRE ALARM OR EMERGENCY SYSTEM, OR LOSS OF POWER TO THE DEVICE

HARDWARE GROUP NO. A09

For use on Door #(s):

1.105-A

Provide each door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	HANGING DEVICE	BY ALUMINUM DOOR/FRAME MANUFACTURER		
1	EA	FIXED CENTER MULLION	BY ALUMINUM DOOR/FRAME MANUFACTURER		
2	EA	PUSH BAR	9100HD-O	630	IVE
2	EA	SURF. AUTO OPERATOR	4642 CS TBWMS 120 VAC	689	LCN
1	EA	ACTUATOR KIT	8310-3853TWF	630	LCN
2	EA	RECEIVER	8310-865		LCN
1	EA	FLOOR STOP	FS17	626	IVE
1	EA	WALL STOP	WS401/402CVX	626	IVE
1	EA	WEATHERSTRIPPING	BY ALUMINUM DOOR/FRAME MANUFACTURER.		
2	EA	DOOR SWEEP	BY ALUMINUM DOOR/FRAME MANUFACTURER.		
2	EA	THRESHOLD	BY ALUMINUM DOOR/FRAME MANUFACTURER.		

EXIT ONLY. NO ENTRANCE
 REMOVED CARD READER, PANIC DEVICE, LONG PULL PER OWNER'S COMMENTS 04.12.2023.
 REPLACED PANIC DEVICE WITH CROSS BAR.

ACTUATOR IS CONTROLLED BY THE OPERATOR

3.07 DOOR INDEX

Legend:

↗ Electrified Opening

Door#	HwSet#
1.101-A↗	A01
1.101-B↗	A01A
1.102-A↗	04
1.102-B↗	04
1.103↗	A03A
1.105-A↗	A09
1.107	41
1.107A	21
1.107B	21
1.107C	21
1.107D	21
1.107E	21
1.107F	21
1.107G	21
1.107H	21
1.201	08B
1.202↗	08A
1.203A↗	08
1.203B	22
1.302A	49
1.302B	49
1.303A	49
1.303B	49
1.304	49
1.306	22
2.102-A	33
2.102-B	32
2.103A	24A
2.103B	24A
2.104-A↗	37B
2.104-B↗	36
2.104-C	49
2.202A-A	33
2.202A-B	32
2.202B-A	33
2.202B-B	32
2.202C-A	33
2.202C-B	32
2.203A1	24A

Door#	HwSet#
2.203A2	24A
2.203B1	24A
2.203B2	24A
2.203C1	24A
2.203C2	24A
2.204A-A↗	37B
2.204A-B↗	37B
2.204A-C	49
2.204A-D	41A
2.204B-A↗	37B
2.204B-B↗	37B
2.204B-C	49
2.204B-D	41A
2.204C-A↗	37B
2.204C-B↗	37B
2.204C-C	49
2.204C-D	41A
2.205A-A	41A
2.205A-B	41A
2.205B	17
2.301A	41A
2.302A-A	33
2.302A-B	32
2.302B-A	33
2.302B-B	32
2.302C-A	33
2.302C-B	32
2.302D-A	33
2.302D-B	32
2.303A1	24A
2.303A2	24A
2.303B1	24A
2.303B2	24A
2.303C1	24A
2.303C2	24A
2.303D1	24A
2.303D2	24A
2.304A-A↗	37B
2.304A-B↗	37B

Door#	HwSet#
2.304A-C	49
2.304A-D	41A
2.304B-A↗	37B
2.304B-B↗	37B
2.304B-C	49
2.304B-D	41A
2.304C-A↗	37B
2.304C-B↗	37B
2.304C-C	49
2.304C-D	41A
2.304D-A↗	37B
2.304D-B↗	36
2.304D-C	49
2.306A	08B
2.306B	08B
2.307A-A	41A
2.307A-B	41A
2.402A	32
2.402B	33A
2.403A1	24A
2.403A2	24A
2.404A-A↗	37A
2.404A-B	33A
2.404B↗	37
2.406A	08B
2.406B	08B
2.501A	49
2.501B	49
2.501C	49
2.501D	49
2.502A	49
2.502B	49
2.502C	49
2.502D	49
2.503A-A	49
2.503A-B	49
2.503B-A	49
2.503B-B	49
2.503C-A	49

Door#	HwSet#
2.503C-B	49
2.503D-A	49
2.503D-B	49
2.506A1	42
2.506A2	49
2.506B1	42
2.506B2	49
2.506C1	42
2.506C2	49
2.506D1	42
2.506D2	49
2.601A	08
2.601B	08
2.601C	08
2.601D	08
2.601E	08
2.602A	25
2.602B	25
2.602C	25
2.602D	25
2.602E	25
2.603A1	22
2.603A2	22
2.603B1	22
2.603B2	22
2.603C1	22
2.603C2	22
2.603D1	22
2.603D2	22
2.603E1	22
2.603E2	22
2.605A	26
2.605B	26
2.605C	26
2.605D	26
2.605E	26
2.606A	26
2.606B	26
2.606C	26
2.606D	26
2.606E	26
2.901	24
2.902A	21
2.902B	21

Door#	HwSet#
2.902C	21
2.902D	22
3.101A	44
3.101B	44
3.101C	44
3.101D	44
3.102A	23
3.102B	23
3.102C	23
3.102D	23
3.201A	14A
3.201B	14A
3.201C	14A
3.201D	14A
3.201E	14A
3.201F	14A
3.202A	23
3.202B	23
3.202C	23
3.202D	23
3.202E	23
3.202F	23
3.301	08
3.302	23
3.901A	24
3.902	14B
3.903	46A
3.904A	46A
3.904B	46A
4.101-A	28
4.101-B	28
4.103-A	33B
4.103-B	33B
4.104	40
4.105	24
4.107A	21
4.107B	21
4.201	40
4.203	40
5.101-A	28
5.101-B	10
5.103	08B
5.104	24
5.105A	27

Door#	HwSet#
5.105B	27
5.105C	27
5.105D	27
5.105E	27
5.106	40
5.107	40
5.201	12B
5.201A	12B
5.202	12B
5.203	24
5.903	14A
5.904	40
5.906	24
5.907	14B
6.101A-A	28
6.101B-A	28
6.101B-B	28
6.105-A	12B
6.105-B	12B
6.106	24
6.106-A	12B
6.106-B	12B
6.108	14
6.109	14
6.203	40
6.204	13
6.205	40
6.206	14
6.902A	22
6.902B	22
6.906	101
10.102	35A
10.103A	41A
10.103B	41
10.103C	41A
10.104A	41
10.104B	41
10.104C	41
10.105	41
10.106	41
10.107	01A
10.202	24.2
10.203	24.1
10.205	24

Door#	HwSet#
10.206A	35
10.206B	41
10.206C	41
10.206D	41
10.207	46
10.208	46
10.209A	22
10.209B	22
10.210A	05
10.210B-A	110
10.210B-B	05
10.210C	05
10.210D	49
10.210E	05
10.210F	111
10.210G	112
10.210NN	05
10.301	01
10.302	40
10.303	24
10.304	41
10.305A-A	16.1
10.305A-B	16.1
10.305B	41
10.305C	08
C001	49
C002	49
C003	49
C004-A	49
C004-B	49
C005	49
C006	49
C007	20
C100	A04
C101	10
C101-A	07
C101-B	04
C102-A	04
C102-C	121
C105-A	10
C106	A03
C107	49
C201-A	04
C201A-A	10

Door#	HwSet#
C201-B	04
C205	130
C205-A	10
C206	10
D301	08
D302	08
D401	10
D402	A02
D601-A	10
D601A	28
D601-B	101A
D602	10
D603	101
D604-A	102
D604-B	10
M101	41
MR101	49
MR103	49
ST101-A	12C
ST101-B	18
ST101-C	12C

END OF SECTION 087100

**SECTION 088000
GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing compounds.

1.02 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.
- G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.
- I. GANA (GM) - GANA Glazing Manual 2022.
- J. GANA (SM) - GANA Sealant Manual 2008.
- K. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).
- L. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.
- M. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.
- N. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit two samples in manufacturer's standard size of each glass type.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with GANA (GM), GANA (SM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

1.05 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.

- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with ASCE 7.
 - 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 - 3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7
 - 4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 - 5. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
 - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
 - 3. Solar Optical Properties: Comply with NFRC 300 test method.

2.02 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 - 1. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
 - 2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.

2.03 INSULATING GLASS UNITS

- A. Manufacturers:
 - 1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 - 2. Guardian Glass, LLC: www.guardianglass.com/#sle.
 - 3. Vitro Architectural Glass (formerly PPG Glass); Solarban 60: www.vitroglazings.com/#sle.
- B. Insulating Glass Units: Types as indicated.
 - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV.
 - 3. Warm-Edge Spacers: Low-conductivity thermoplastic with dessicant warm-edge technology design.
 - a. Spacer Width: As required for specified insulating glass unit.
 - b. Spacer Height: Manufacturer's standard.
 - 4. Spacer Color: Black.
 - 5. Edge Seal:

- a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone sealant as secondary seal applied around perimeter.
- b. Color: Black.
6. Purge interpane space with dry air, hermetically sealed.
- C. Insulating Glass Units: Vision glass, double glazed, bronze tint.
 1. Applications: Exterior glazing unless otherwise indicated.
 2. Space between lites filled with argon.
 3. Outboard Lite: Heat-strengthened float glass, 6mm thick, minimum.
 - a. Provide Fully tempered float glass where indicated.
 - b. Tint: Bronze, Solarbronze.
 - c. Coating: Low-E (passive type), on #2 surface.
 4. Warm-edge spacer.
 5. Inboard Lite: Heat-strengthened float glass, 6 mm thick, minimum.
 - a. Provide Fully tempered float glass where indicated.
 - b. Tint: Clear.
 6. Total Thickness: 1 inch.
 7. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, maximum.
 8. Visible Light Transmittance (VLT): 42 percent, minimum.
 9. Solar Heat Gain Coefficient (SHGC): 0.27, maximum.
 10. Visible Light Reflectance, Outside: 7 percent, maximum.
 11. Glazing Method: Wet glazing method, sealant and sealant.
- D. Insulating Glass Units: Vision glass, double glazed, clear.
 1. Applications: Exterior glazing on northern facing exposure..
 2. Space between lites filled with argon.
 3. Outboard Lite: Heat-strengthened float glass, 6mm thick, minimum.
 - a. Provide Fully tempered float glass where indicated.
 - b. Tint: Clear.
 4. Warm-edge spacer.
 5. Total Thickness: 1 inch.
 6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
 7. Visible Light Transmittance (VLT): 70 percent, minimum.
 8. Solar Heat Gain Coefficient (SHGC): 0.39, nominal.
 9. Visible Light Reflectance, Outside: 11 percent, maximum.
 10. Glazing Method: Wet glazing method, sealant and sealant.

2.04 GLAZING COMPOUNDS

- A. Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; gray color.
- B. Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.
- C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.05 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

- C. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal;
- D. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - WET GLAZING METHOD (SEALANT AND SEALANT)

- A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
- B. Place setting blocks at 1/4 points and install glazing pane or unit.
- C. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch intervals, 1/4 inch below sight line.
- D. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 3/8 inch below sight line to ensure full contact with glazing and continue the air and vapor seal.
- E. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.05 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

- A. Application - Interior Glazed: Set glazing infills from the interior of the building.
- B. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.

- C. Locate and secure glazing pane using glazers' clips.
- D. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

END OF SECTION 088000

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**SECTION 088813
FIRE-RATED GLAZING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire-rated glazing units.
- B. Glazing compounds.

1.02 RELATED REQUIREMENTS

- A. Section 084313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.
- B. Section 084435 - Protective Framed Glazing Assemblies: Glazing tested and provided as part of the wall assembly.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).
- C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1036 - Standard Specification for Flat Glass 2021.
- F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass 2019.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- H. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.
- I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- J. GANA (GM) - GANA Glazing Manual 2022.
- K. GANA (SM) - GANA Sealant Manual 2008.
- L. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. ITS (DIR) - Directory of Listed Products Current Edition.
- N. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
- O. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.
- P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.
- Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2023.
- R. UL (DIR) - Online Certifications Directory Current Edition.
- S. UL 10B - Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- U. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene preinstallation meeting one week before starting work of this section; require attendance by each of affected installers.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Certificate: Certify that products of this section meet or exceed specified requirements.
- E. Manufacturer's qualification statement.

1.06 QUALITY ASSURANCE

- A. Perform work in accordance with GANA (GM) and GANA (SM) for glazing installation methods. Maintain one copy on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
 - 1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 FIELD CONDITIONS

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty for Insulating Glass Units: Provide five-year manufacturer warranty coverage for seal failure, interpane dusting or misting, including providing products to replace failed units, and commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
- C. Manufacturer Warranty for Laminated Glass: Provide five-year manufacturer warranty coverage for delamination, including providing products to replace failed units, and commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
- D. Manufacturer Warranty for Heat Soaked Tempered Glass: Provide five-year manufacturer warranty coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions, and commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Glass Fabricators:
- B. Fire-Protection-Rated Glass:
 - 1. Manufacturers:
 - a. SAFTIFIRST, a division of O'Keeffe's Inc: www.safti.com/#sle.
 - b. Technical Glass Products: www.fireglass.com/#sle.
 - c. Vetrotech North America: www.vetrotechusa.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads and withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 - 1. Design Pressure: Calculated in accordance with ASCE 7.

2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 3. Provide glass edge support system sufficiently stiff to limit lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 4. Glass thicknesses listed are minimum.
- B. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated, in accordance with manufacturer's published data as determined with the following procedures or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW software.
 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW software.
 3. Solar Optical Properties: Comply with NFRC 300 test method.
- C. Fully Tempered Safety Glass: Comply with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.

2.03 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
- B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Comply with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
 2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.
 3. Ionoplast Interlayer: 0.035 inch thick, minimum.

2.04 GLAZING UNITS

- A. Fire-Resistance-Rated Glazing: Type, thickness, and configuration of glazing that contains flames, smoke, and blocks radiant heat, as required to achieve indicated fire rating period exceeding 45 minutes.
1. Applications:
 - a. Glazing in fire-rated door assembly.
 - b. Glazing in fire-rated window assembly.
 2. Glass Type: Multi-laminate annealed glass with intumescent fire retardant interlayers.
 3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
 4. Safety Glazing Certification: 16 CFR 1201 Category II.
 5. Glazing Method: As required for fire rating.
 6. Fire Rating Period: As indicated on drawings.
 7. Markings for Fire-Resistance-Rated Glazing Assemblies: Provide permanent markings on fire-resistance-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction.
 - a. "W" - meets wall assembly criteria of ASTM E119 or UL 263 fire test standards.
 - b. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
 - c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire test standards.
 - d. "T" - meets temperature rise of not more than 450 degrees F above ambient at end of 30 minutes fire exposure in accordance with NFPA 252, UL 10B, or UL 10C fire test standards.
 - e. "XXX" - placeholder that represents fire rating period, in minutes.

2.05 GLAZING COMPOUNDS

- A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

2.06 ACCESSORIES

- A. Setting Blocks: As recommended in writing by glazing manufacturer.
- B. Glazing Tape: As recommended in writing by glazing manufacturer.
- C. Glazing Gaskets: Flexible intumescent seals.

2.07 SOURCE QUALITY CONTROL

- A. Provide shop inspection and testing for fire-resistant glass.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION - GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers unless more stringent requirements are indicated, including those in referenced glazing standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with contaminating substances that may result from construction operations including, but not limited to weld spatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

- A. Application - Interior Glazed: Set glazing infills from interior of building.
- B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sightline.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- E. Place glazing tape on free perimeter of glazing in same manner described above.
- F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

- G. Carefully trim protruding tape with knife.

3.05 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)

- A. Application - Interior Glazed: Set glazing infills from interior of building.
- B. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch above sightline.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- D. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- E. Install removable stops, spacer shims inserted between glazing and applied stops at 24-inch intervals, 1/4 inch below sight line.
- F. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line.
- G. Carefully trim protruding tape with knife.

3.06 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than four days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 PROTECTION

- A. After installation, mark pane with 'X' by using removable plastic tape or paste; do not mark heat-absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 088813

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**SECTION 092116
GYPSUM BOARD ASSEMBLIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Gypsum sheathing.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.
- H. Bullet resistant sheathing and wallboard.

1.02 RELATED REQUIREMENTS

- A. Section 072100 - Thermal Insulation: Acoustic insulation.
- B. Section 072500 - Weather Barriers: Water-resistive barrier over sheathing.
- C. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work including acoustical backer pads for outlets.
- D. Section 102641 - Bullet Resistant Panels: Bullet resistant fiberglass panels used in gypsum board assemblies.
- E. Section 134813 - Manufactured Sound and Vibration Control Components: Sound isolation clips used in conjunction with gypsum board assemblies.

1.03 REFERENCE STANDARDS

- A. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data 2017.
- B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing 2020.
- C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing 2015, with Errata (2020).
- D. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- E. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.
- F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- H. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.
- I. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- J. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- K. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- L. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness 2022.

- M. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs 2022.
- N. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- O. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- P. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing 2018.
- Q. ASTM C1288 - Standard Specification for Fiber-Cement Interior Substrate Sheets 2017.
- R. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units 2022.
- S. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- T. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- U. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- V. ASTM E413 - Classification for Rating Sound Insulation 2022.
- W. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- X. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data:

1.05 MOCK-UP

- A. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
- B. Construct mock-up of leve 4 (light skip trowel) gypsum board finish.
 - 1. Use same materials and methods for use in the work.
 - 2. Locate where directed.
 - 3. Minimum Size: 4 by 4 feet.
- C. Obtain approval of mock-up by Architect before proceeding with work.
- D. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
 - 1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
 - 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:

1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- E. Fire-Resistance-Rated Assemblies: Provide completed assemblies as indicated on Drawings and complying with applicable code.

2.02 METAL FRAMING MATERIALS

- A. Material and Product Requirements Criteria: AISI S201.
- B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
- C. Manufacturers - Metal Framing, Connectors, and Accessories:
1. ClarkDietrich: www.clarkdietrich.com/#sle.
 2. Jaimes Industries: www.jaimesind.com/#sle.
 3. MarinoWARE: www.marinoware.com/#sle.
 4. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
 5. SCAFCO Corporation: www.scafco.com/#sle.
 6. Steel Construction Systems: www.steelconsystems.com/#sle.
 7. Supreme Steel Framing System Association; : www.ssfsa.com//#sle.
- D. Minimum Base-Metal Thickness: Minimum 0.027 inch (22 gauge) for gypsum wallboard, minimum 0.312 for tile backing panels, or greater as recommended by tile backer panel manufacturer, or greater as indicated in the manufacturer's published performance data based on the following criteria:
1. Yield Strength of steel.
 2. Deflection Limits:
 - a. Gypsum Wallboard: L/240.
 - b. Ceramic Tile: L/360.
 - c. Plaster: L/360.
 3. Limiting heights: As indicated on Drawings.
 4. Spans: as indicated on Drawings or as recommended by manufacturer.
 5. Applied loads, composite or non-composite construction, as appropriate:
 - a. Gypsum wallboard: 5 psf.
 - b. Ceramic tile, one side: 15 psf.
 - c. Ceramic tile, two sides: 30 psf.
 6. Depth: As indicated on Drawings
- E. Non-structural Framing System Components: ASTM C645; hot-dip galvanized ASTM A653/A653M G40 sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
1. Studs: C-shaped with knurled or embossed faces.
 2. Paired Studs for Sound-Rated Assemblies: Engineered single-piece assemblies comprised of paired studs coupled by sound isolators, designed to replace conventional side-by-side, parallel, double-wall partition framing.
 3. Runners: U shaped, sized to match studs.
 4. Ceiling Channels: C-shaped.
 5. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
 6. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.
 7. Resilient Sound Isolation Clips: Section134813.
- F. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
- G. Area Separation Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with specified performance requirements.

- H. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.
- I. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
- J. Preformed Top Track Firestop Seal:
 - 1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
- K. Preformed Top of Wall Firestop Gasket:
 - 1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
- L. Non-structural Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 - 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
 - 3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
 - 4. Beam and column clip: Galvanized steel.
 - 5. Fasteners for Metal Framing: Type, material, size, corrosion resistance holding power, and other properties required to fasten steel members to substrates.
- M. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.

2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
 - 1. American Gypsum Company: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/#sle.
 - 3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
 - 4. USG Corporation: www.usg.com/#sle.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 - 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 - a. Use ASTM D3273 moisture- and mold-resistant, score of 10, Type X at shaft wall assemblies.
 - 1) Thickness: 1 inch.
 - 2) Long Edges: Double-bevel.
 - 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Type X, unless otherwise indicated: 5/8 inch.
- C. Abuse Resistant Wallboard:
 - 1. Application: High-traffic areas indicated.
 - 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 - 3. Type: Fire-resistance-rated Type X, UL or WH listed.
 - 4. Thickness: 5/8 inch.
 - 5. Edges: Tapered.
- D. Backing Board For Wet Areas: One of the following products:

1. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
 - a. Thickness: 1/2 inch.
2. ASTM Cement-Based Board: Non-gypsum-based, cementitious board complying with ASTM C1288.
 - a. Thickness: 1/2 inch.
- E. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
 1. Application: Vertical surfaces behind thinset tile, except in wet areas.
 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 3. Type: Regular and Type X, in locations indicated.
 4. Type X Thickness: 5/8 inch.
 5. Regular Board Thickness: 1/2 inch.
 6. Edges: Tapered.
- F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
 1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: 1/2 inch.
 3. Edges: Tapered.
- G. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
 1. Application: Exterior sheathing, unless otherwise indicated.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 3. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
 4. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
 5. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 6. Core Type: Regular and Type X, as indicated.
 7. Thickness: 5/8 inch.
 8. Edges: Square.
- H. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
 1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
 2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.04 GYPSUM BOARD ACCESSORIES

- A. Acoustic Insulation: See Section 072100.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Water-Resistive Barrier: See Section 072500.
- D. Finishing Accessories: ASTM C1047, extruded aluminum alloy (6063 T5) or galvanized steel sheet ASTM A924/A924M G90, unless noted otherwise.
 1. Types: As detailed or required for finished appearance.
- E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners for glass-mat gypsum sheathing board.
 2. Paper Tape: 2 inch wide, creased paper tape for joints and corners at interior gypsum board.

3. Joint Compound: For Interior Gypsum Board
 - a. Drying type, all purpose.
 - 1) Use for fill coat.
 - b. Setting type, taping compound.
 - 1) Use for prefilling, embedding tap, initial coat on joints, fasteners, and trim flanges.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.
- H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
 1. Install studs at spacing required to meet performance requirements.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.03 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
- C. Studs: Space studs at 16 inches on center.
 1. Extend partition framing to structure where indicated and to ceiling in other locations.
 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
- G. Resilient Sound Isolation Clips: Install resilient sound isolation clips, and where applicable, associated furring sections and channels, in accordance with clip manufacturer's written instructions.
- H. Blocking: Install mechanically fastened steel sheet blocking for support of:
 1. Wall-mounted cabinets.
 2. Plumbing fixtures.
 3. Toilet accessories.
 4. Wall-mounted door hardware.

3.04 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Sound control putty pads at outlet boxes: Install according to manufacturer's written Acoustic Sealant: Install in accordance with manufacturer's instructions.
- C. Sound control putty pads at outlet boxes: Install according to manufacturer's written instructions. Coordinate installation with requirements in Division 26.
- D. Coordinate installation of sound and vibration control components with Section 134813.

3.05 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
 - 1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.
- E. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Decorative Trim: Install at locations shown on Drawings and in accordance with manufacturer's written instructions.
- D. Security Mesh: Install at locations shown on Drawings and in accordance with manufacturer's written instructions.

3.07 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 4 (Light skip trowel): Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- D. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.08 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 092116

**SECTION 093000
TILING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Tile.
- B. Tile for floor applications.
- C. Tile for wall applications.
- D. Coated glass mat backer board as tile substrate.
- E. Ceramic accessories.
- F. Non-ceramic trim.

1.02 REFERENCE STANDARDS

- A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
- B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- C. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).
- D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).
- M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).
- N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2020.
- O. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs 2020.

- P. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2021.
- Q. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2019.
- R. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2014 (Reaffirmed 2019).
- S. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).
- T. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar 2019.
- U. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2022.
- V. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018 (Reapproved 2023).
- W. ASTM C482 - Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement Paste 2020.
- X. ASTM C648 - Standard Test Method for Breaking Strength of Ceramic Tile 2020.
- Y. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- Z. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- AA. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
- BB. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- CC. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.
- E. Installer's Qualification Statement:
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 10 square feet of each size, color, and surface finish combination.

1.04 MOCK-UPS

- A. See Section 014000 - Quality Requirements for general requirements for mock-up.
- B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
 - 1. Minimum size of mock-up is indicated on drawings.

2. Approved mock-up may remain as part of work.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

- A. Basis-of-Design Product: The design for tiling is based on products indicated on Drawings. Subject to compliance with requirements, another manufacturer's tile of a similar and equivalent nature will be acceptable when, in the Architect's sole judgment, differences do not materially detract from the design concept, aesthetics, or intended performance.
 1. Basis of Design Manufacturer: Atlas Concorde USA; www.atlasconcordeusa.com/#sle
 2. Products from the following manufacturers may be considered:
 - a. Crossville, Inc: www.crossvilleinc.com/#sle.
 - b. Dal-Tile Corporation: www.daltile.com/#sle.
 - c. Emser Tile, LLC: www.emser.com/#sle.
- B. Porcelain Floor Tile, Types FT1, FT2, FT3: ANSI A137.1 standard grade.
 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
 2. Breaking Strength: Not less than 350 lbf, average and not less than 350 lbf for individual tiles when tested in accordance with ASTM C648.
 3. Bond Strength: Not less than 100 psi when tested in accordance with ASTM C482.
 4. Dynamic Coefficient of Friction (DCOF): Not less than 0.42.
 5. Dimensions: As indicated on Drawings.
 6. Color: As indicated on Drawings.
 7. Products: As indicated on Drawings.
- C. Porcelain Wall Tile, Types WT1, WT2, W5: ANSI A137.1 standard grade.
 1. Breaking Strength: Not less than 350 lbf, average and not less than 350 lbf for individual tiles when tested in accordance with ASTM C648.
 2. Bond Strength: Not less than 100 psi when tested in accordance with ASTM C482.
 3. Dimensions: As indicated on Drawings.
 4. Shapes: As indicated on Drawings.
 5. Color: As indicated on Drawings.
 6. Products: As indicated on Drawings.
- D. Porcelain Wall Tile, Types WT3: Dimensional porcelain tile, matte finish, rectified edges .
 1. Dimensions: As indicated on Drawings.
 2. Shapes: As indicated on Drawings.
 3. Color: As indicated on Drawings.
 4. Products: As indicated on Drawings.
- E. Porcelain Wall Tile, Types W4: Dimensional glazed ceramic tile .
 1. Moisture Absorption: Not more than 20 percent as tested in accordance with ASTM C373.
 2. Breaking Strength: Not less than 120 lbf, average and not less than 350 lbf for individual tiles when tested in accordance with ASTM C648.
 3. Dimensions: As indicated on Drawings.
 4. Shapes: As indicated on Drawings.
 5. Color: As indicated on Drawings.
 6. Products: As indicated on Drawings.

2.02 TRIM AND ACCESSORIES

- A. Trim: Satin natural anodized extruded aluminum, style and dimensions as indicated on Drawings, for setting using tile mortar or adhesive.
 - 1. Applications:
 - a. Open edges of wall tile as indicated on Drawings.
 - b. Wall corners, outside and inside, as indicated on Drawings.
 - c. Floor to wall joints as indicated on Drawings.
 - 2. Manufacturers: Subject to compliance with requirements, provide Basis of Design products indicated on Drawings, or a comparable Architect-approved product by one of the following:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Genesis APS International: www.genesis-aps.com/#sle.

2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
 - 1. ARDEX Engineered Cements: www.ardexamericas.com/#sle.
 - 2. Bostik Inc: www.bostik-us.com/#sle.
 - 3. Custom Building Products: www.custombuildingproducts.com/#sle.
 - 4. H.B. Fuller Construction Products, Inc: www.tecspecialty.com/#sle.
 - 5. LATICRETE International, Inc: www.laticrete.com/#sle.
 - 6. MAPEI Corporation:
 - 7. Merkrete, by Parex USA, Inc: www.merkrete.com/#sle.
- C. Large and Heavy Tile (LHT) Mortar (Formerly Medium-Bed, Modified Dry-Set Mortar): ANSI A118.4.
 - 1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
- D. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.

2.04 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
 - 1. Color(s): As indicated on drawings.

2.05 ACCESSORY MATERIALS

- A. Transition Strips: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive. Comply with ICC A117.1.
 - 1. Applications:
 - a. Transition between floor finishes of different heights:
 - 1) Floor tile to resilient flooring.
 - (a) Basis of Design: Schluter Schiene
 - 2) Floor tile to concrete.
 - (a) Basis of Design: Schluter Reno-Ramp
 - 3) Floor tile to carpet.
 - 2. Manufacturers: Subject to compliance with requirements, provide Basis of Design products indicated on Drawings, or a comparable Architect-approved product by one of the following:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Genesis APS International: www.genesis-aps.com/#sle.
- B. Waterproofing / Uncoupling Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
 - 1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.

2. Bonded Sheet Membrane Type:
 - a. Material: Polyethylene sheet membrane with non-woven fabric laminated to both sides, 20 to 30 mils thick, nominal.
 - b. Products:
 - 1) Schluter; DiTRA: /www.schluter.com or approved equal.
- C. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
- D. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
- E. Tile Leveling System: Clips for large format tile installation to provide installed level surface.
- F. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
 1. Test in accordance with Section 090561.
 2. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 3. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
 4. Follow moisture and alkalinity remediation procedures in Section 090561.
- E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Install tile and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Install trim and transition strips according to manufacturer's written instructions.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

3.05 INSTALLATION - WALL TILE

- A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.
- B. Over metal studs without backer install in accordance with TCNA (HB) Method W241, mortar bed, with membrane where indicated.

3.06 CLEANING

- A. Clean tile and grout surfaces.

3.07 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION 093000

**SECTION 095100
ACOUSTICAL CEILINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.02 RELATED REQUIREMENTS

- A. Section 111950 - Detention Ceiling Panel Systems: For ceiling systems used in detention areas.

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.
- C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
- D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.
- E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning.
- C. Evaluation Service Reports: Show compliance with specified requirements.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acoustic Tiles/Panels: Subject to compliance with requirements, provide Basis of Design product indicated on Drawings, or a comparable Architect-approved product by one of the following:
 - 1. Basis of Design: Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
 - 2. CertainTeed Corporation: www.certainteed.com/ceilings-and-walls/#sle.
 - 3. USG Corporation: www.usg.com/ceilings/#sle.

2.02 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category C and complying with the following:
1. Local authorities having jurisdiction.

2.03 ACOUSTICAL UNITS

- A. Acoustical Panels: Painted mineral fiber, with the following characteristics:
1. Provide product(s) indicated in Materials Key on Drawings.
 - a. ASTM E1264 for Type, Form, and Pattern for Basis of Design producte indicated in Materials Key on Drawings.
- B. Acoustical Panels, Type ACT 4: Painted mineral fiber, with the following characteristics:
1. Classification: ASTM E1264 Type III.
 - a. Form: 2, water felted.
 - b. Pattern: C, D, K.
 2. Size: 24 by 48 inches.
 3. Thickness: 5/8 inch.
 4. Light Reflectance: 0.80 percent, determined in accordance with ASTM E1264.
 5. NRC Range: 0.55, determined in accordance with ASTM E1264.
 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 7. Panel Edge: Square.
 8. Suspension System: Exposed grid.
 9. Products:
 - a. Basis of Design: Armstrong World Industries, Inc; Cortega: www.armstrongceilings.com/#sle.
 - b. CertainTeed Corporation: www.certainteed.com/ceilings-and-walls/#sle.
 - c. USG Corporation: www.usg.com/ceilings/#sle.
- C. Acoustical Panels, Type ACT 1, ACT 2, ACT 3: Glass fiber with membrane-faced overlay, attached to suspended ceiling grid with baffle clips, with the following characteristics:
1. Classification: ASTM E1264 Type XII.
 2. Size:
 - a. ACT 1: 24 by 24 inches.
 - b. ACT 2: 24 by 48 inches.
 - c. ACT 3: 24 by 72 inches.
 3. Thickness: 1 inch.
 4. Light Reflectance: 0.88 percent, determined in accordance with ASTM E1264.
 5. NRC Range: 0.90 to 0.95, determined in accordance with ASTM E1264.
 6. Articulation Class (AC): Determined in accordance with ASTM E1264.
 - a. ACT 1: 200.
 - b. ACT 2, ACT 3: 190
 7. Ceiling Attenuation Class (CAC): For ACT 1, 26, determined in accordance with ASTM E1264.
 8. Panel Edge: Square.
 9. Suspension System: Exposed grid.

2.04 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

- C. Exposed Suspension System: Hot-dipped galvanized steel grid with steel cap.
 - 1. Application(s): Seismic.
 - 2. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
 - 3. Profile: Tee; 15/16 inch face width.
 - 4. Finish: Baked enamel.
 - 5. Color: As indicated in Materials Key on Drawings.

2.05 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Hold-Down Clips: Manufacturer's standard clips to suit application.
- D. Perimeter Moldings: Same metal and finish as grid.
 - 1. Size: As required for installation conditions.
 - 2. Profile: As indicate on Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.
- C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

3.03 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
- D. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- E. Seismic Suspension System, Seismic Design Category C: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Maintain a 3/8 inch clearance between grid ends and wall.
- F. Seismic Suspension System, Seismic Design Categories D, E, F: Hang suspension system with grid ends attached to the perimeter molding on two adjacent walls; on opposite walls, maintain a 3/4 inch clearance between grid ends and wall.
- G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

- I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- J. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
- F. Where round obstructions occur, provide preformed closures to match perimeter molding.

3.05 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

- A. Clean surfaces.
- B. Replace damaged or abraded components.

END OF SECTION 095100

**SECTION 096500
RESILIENT FLOORING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Resilient sheet flooring.
- B. Resilient base.
- C. Resilient stair accessories.
- D. Installation accessories.

1.02 RELATED REQUIREMENTS

- A. Section 093000 - Tiling: Transition strip for transitions from resilient flooring to tile flooring.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- D. ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing 2004 (Reapproved 2021).
- E. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
- F. ASTM F2169 - Standard Specification for Resilient Stair Treads 2015 (Reapproved 2020).
- G. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- H. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.
- J. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.07 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 SHEET FLOORING

- A. Vinyl Sheet Flooring - Type SV1: Color and pattern throughout wear layer thickness, with backing.
 - 1. Minimum Requirements: Comply with ASTM F1303, Type II, with Class as backing.
 - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 3. Wear Layer Thickness: 0.050 inch minimum.
 - 4. Total Thickness: 0.080 inch minimum.
 - 5. Color: As indicated on Drawings.

2.02 STAIR COVERING

- A. Stair Risers: Full height and width of tread in one piece, matching treads in material and color.
 - 1. Thickness: 0.080 inch.
- B. Stair Treads with Integral Risers: Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
 - 1. Manufacturers:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com.
 - b. Mannington Commercial: www.manningtoncommercial.com#sle.
 - c. Roppe Corporation: www.roppe.com/#sle.
 - 2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
 - 3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 - 4. Nosing: Square.
 - 5. Striping: 2 inch wide contrasting color strips.
 - 6. Tread Texture: Smooth.
 - 7. Color: As indicated on drawings.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended in writing by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended in writing by flooring manufacturer.
- C. Transition Strips: Vinyl t-molding, size as required for thickness of flooring, color as indicated on Drawings. Comply with ICC A117.1.
 - 1. Install at transitions from carpet-to-vinyl flooring.
 - 2. Manufacturers: Subject to compliance with requirements, provide Basis of Design product as indicated on Drawings, or a comparable Architect-approved product by one of the following:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - b. Mannington Commercial: www.manningtoncommercial.com#sle.
 - c. Roppe Corporation: www.roppe.com/#sle.
- D. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Prepare floor substrates as recommended in writing by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is fully cured.
- E. Clean substrate.

3.03 INSTALLATION - GENERAL

- A. Starting installation constitutes acceptance of conditions.
- B. Install in accordance with manufacturer's written instructions.
- C. Adhesive-Applied Installation:
 - 1. Spread only enough adhesive to permit installation of materials before initial set.
 - 2. Fit joints and butt seams tightly.
 - 3. Set flooring in place, press with heavy roller to attain full adhesion.

3.04 INSTALLATION - SOUND CONTROL UNDERLAYMENT

- A. Install in accordance with underlayment manufacturer's instructions.

3.05 INSTALLATION - STAIR COVERINGS

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Install stringers configured tightly to stair profile.
- C. Adhere over entire surface. Fit accurately and securely.

3.06 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 096500

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**SECTION 096813
TILE CARPETING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

- A. Section 093000 - Tiling: Transition strips for carpet-to-tile flooring applications.

1.03 REFERENCE STANDARDS

- A. AATCC Test Method 16 - Colorfastness to Light 2004, with Editorial Revision (2010).
- B. AATCC Test Method 134 - Test Method for Electrostatic Propensity of Carpets 2019.
- C. AATCC Test Method 174 - Test Method for Antimicrobial Activity Assessment of New Carpets 2022.
- D. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).
- E. ASTM D7330 - Standard Test Method for Assessment of Surface Appearance Change in Pile Floor Coverings Using Standard Reference Scales 2022.
- F. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- G. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- H. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
- I. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes 2019a.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- K. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.
- L. PS 1 - Structural Plywood 2019.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
 - 1. If products submitted are those other than the indicated Basis of Design but from manufacturers listed as acceptable, include a table with a side-by-side comparison of the submitted product and the Basis of Design. Include physical properties and performance data as specified.
- C. Shop Drawings: Indicate layout of joints.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Tile Carpeting:
 - 1. Basis-of-Design Product: The design for carpet tile is based on products indicated on Drawings. Subject to compliance with requirements, another manufacturer's carpet tile of a similar and equivalent nature will be acceptable when, in the Architect's sole judgment in consultation with Owner, differences do not materially detract from the design concept, aesthetics, or intended performance.
 - a. Basis of Design Manufacturer: Interface, Inc: www.interface.com/#sle.
 - 2. Acceptable manufacturers:
 - a. Shaw Floors: www.shawfloors.com/#sle.
 - b. Tarkett SA: www.commercial.tarkett.com/#sle.

2.02 MATERIALS

- A. Tile Carpeting, Types CPT1, CPT2, CPT3, CPT4, CPT5: Multi-level pattern loop, 1Type 6 nylon, 100 percent solution dyed with manufacturer's integral stain protection.
 - 1. Performance:
 - a. Comply with applicable requirements of ICC A117.1.
 - b. Critical Radiant Flux: Minimum of 0.45 watts/sq cm (Class I) watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
 - c. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
 - d. Maximum Electrostatic Charge: Maximum 3 Kv. at 20 percent relative humidity, when tested in accordance with AATCC Test Method 134.
 - e. Light Fastness: Not less than 4.0 at 40 hours of accelerated fading units, when tested in accordance with AATCC Test Method 16.
 - f. Antimicrobial Activity: No fungal growth after 7 days when tested in accordance with AATCC Test Method 174.
 - g. Appearance Retention Rating, ASTM D7330: Not less than 3.0 for heavy traffic.
 - 2. Tile Size: As indicated on Drawings.
 - 3. Gauge: 1/12 inch.
 - 4. Stitches: 11.50 per inch.
 - 5. Pile Weight: 17 oz/sq yd.
 - 6. Primary Backing Material: As indicated on Drawings.
- B. Walk Off Carpet Tile, Types WOC1: Textured loop, nylon 6, 100 percent solution dyed with manufacturer's fiber-applied stain protection.
 - 1. Performance:
 - a. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
 - b. Maximum Electrostatic Charge: Maximum 3 Kv. at 20 percent relative humidity, when tested in accordance with AATCC Test Method 134.
 - c. Light Fastness: Not less than 4.0 at 40 hours of accelerated fading units, when tested in accordance with AATCC Test Method 16.
 - 2. Tile Size: As indicated on Drawings.
 - 3. Gauge: 1/10 inch.
 - 4. Stitches: 9.00 per inch.
 - 5. Pile Density: 6607 oz/cu yd; plus or minus 10 percent.
 - 6. Primary Backing Material: Laminated vinyl and fiberglass.

2.03 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Plywood Underlayment: 5-ply birch underlayment, PS 1, C-D Plugged or better.at Raised Floor Assemblies in Courtroom.

- C. Edge Guards: Vinyl, 1/4 inch material to floor, color as indicated on Drawings. Comply with ICC A117.1.
 - 1. Install at transitions from carpet-to-concrete flooring.
 - 2. Manufacturers: Subject to compliance with requirements, provide Basis of Design product as indicated on Drawings, or a comparable Architect-approved product by one of the following:
 - a. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
 - b. Mannington Commercial: www.manningtoncommercial.com/#sle.
 - c. Roppe Corporation: www.roppe.com/#sle.
- D. Transition Strips: See Section 096500 - Resilient Flooring for transition strips for carpet-to-vinyl flooring transitions.
- E. Adhesives:
 - 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- F. Carpet Tile Adhesive: Recommended in writing by carpet tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
 - 1. Test as Follows:
 - a. Alkalinity (pH): ASTM F710.
 - b. Internal Relative Humidity: ASTM F2170.
 - c. Moisture Vapor Emission: ASTM F1869.
 - 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

- A. Remove existing carpet tile.
- B. Prepare floor substrates as recommended in writing by flooring and adhesive manufacturers.
- C. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- E. Vacuum clean substrate.

3.03 INSTALLATION

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's written instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in pattern as indicated on Drawings, set aligned as indicated on shop drawings.
- F. Locate change of color or pattern between rooms under door centerline.

- G. Fully adhere carpet tile to substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- C. Clean and vacuum carpet surfaces.

END OF SECTION 096813

**SECTION 098430
SOUND-ABSORBING WALL AND CEILING UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sound-absorbing panels.

1.02 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2023.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout and fabric orientation.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

PART 2 PRODUCTS

2.01 FABRIC-COVERED SOUND-ABSORBING UNITS

- A. Manufacturers: Provide basis of design or a comparable Architect approved product by one of the following:
 - 1. Basis of Design: NovaWall; Novawall Systems, Inc. <https://novawall.com/>.
 - 2. Conwed Designscape/Wall Technology: www.conweddesignscape.com/#sle.
 - 3. Egan Visual Corporation: www.egan.com/#sle.
 - 4. NetWell Noise Control: www.controlnoise.com/#sle.
- B. General:
 - 1. Prefinished, factory assembled fabric-covered panels.
 - 2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Fabric-Covered Acoustical Panels for Walls:
 - 1. Panel Core: Manufacturer's standard core.
 - a. Acoustic Interlayer: Manufacturer's standard
 - 2. Sound Absorption: Noise Reduction Coefficient (NRC) of 0.9 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
 - 3. Panel Size: As indicated on Drawings.
 - 4. Panel Thickness: 2 inches.
 - 5. Fabric: Biobased polyethylene.
 - 6. Color: As indicated.
 - 7. Mounting Method: As indicated on Drawings.

2.02 FABRICATION

- A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.

1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.
 2. For panels suspended from ceiling, provide fabric covering both sides, with seams only at panel edges.
- B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.03 ACCESSORIES

- A. Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal:
- B. Fixing Clips: Manufacturers standard for application as indicated.
- C. Panel Adhesive: Acceptable to acoustical panel manufacturer for application as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Install mounting accessories and supports in accordance with shop drawings.

3.03 CLEANING

- A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

- A. Provide protection of installed acoustical panels until Date of Substantial Completion.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION 098430

**SECTION 099113
EXTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise 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. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- B. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- C. SSPC-SP 2 - Hand Tool Cleaning 2018.
- D. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number, if applicable (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.05 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
- B. Paints:
 - 1. Behr Process Corporation: www.behr.com/#sle.
 - 2. Cloverdale Paint, Brand Products of Rodda Paint Company: www.cloverdalepaint.com/#sle.
 - 3. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 - 4. Dow: www.dow.com/#sle.
 - 5. PPG Paints: www.ppgpaints.com/#sle.
 - 6. Rodda Paint Company: www.roddapaint.com/#sle.
 - 7. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 - 4. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal surfaces not indicated to receive High Performance Coatings.
- B. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, brick, fiber cement siding, primed wood, and primed metal.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Exterior Latex, High Performance Architectural; MPI #311 or 315.
 - a. Location: Existing brick where indicated on Drawings.
 - b. Products:
 - 1) Behr Paint, Premium Plus Exterior SemiGloss Enamel 5050, Semi-Gloss. (MPI #141).
 - 2) PPG Paints Sun Proof Exterior Latex, 78-110XI Series, Semi-Gloss. (MPI #311)
 - 3) PPG Paints Acri-Shield Max Exterior Latex, 649-10 Series, Semi-Gloss. (MPI #311)
 - c. Top Coat Sheen: As selected by Architect
 - d. Primer: As specified under "PRIMERS" below and as recommended in writing by top coat manufacturer for specified substrate.
 - 3. Top Coat(s): Exterior Light Industrial Coating, Water Based; MPI #161, 163, or 164.
 - a. Location: Exterior metal surfaces not indicated to receive High Performance Coatings.

- b. Refer to Section 099600 - High-Performance Coatings for exterior substrates to receive high performance coating systems.
- c. Products:
 - 1) Behr Premium Interior/Exterior Direct-To-Metal Paint.
 - 2) PPG Paints Pitt-Tech Plus EP DTM Industrial Enamel.
 - 3) Sherwin-Williams Pro Industrial DTM Acrylic.
- 4. Top Coat Sheen: As selected by Architect
- 5. Primer: As specified under "PRIMERS" below and as recommended in writing by top coat manufacturer for specified substrate.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Alkali Resistant Water Based Primer; MPI #3.
 - a. Location: Existing brick indicated to be painted.
 - b. Products:
 - 1) Behr Concrete and Masonry Bonding Primer [No.880].
 - 2) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI. (MPI #3)
 - 3) Sherwin-Williams Loxon Concrete and Masonry Primer Sealer, LX02W50. (MPI #3)
 - 2. Water Based Primer for Galvanized Metal; MPI #134.
 - a. Galvanized metals indicated to be painted.
 - b. Products:
 - 1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No.436]. (MPI #134)
 - 2) PPG Paints Pitt-Tech Plus EP DTM Industrial Primer, 90-1912. (MPI #134)
 - 3) Sherwin-Williams DTM Primer/Finish (MPI #134)
 - 4) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer. (MPI #134)
 - 3. Rust-Inhibitive Water Based Primer; MPI #107.
 - a. Location: Metal surfaces indicated to be painted.
 - b. Products:
 - 1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No.436]. (MPI #107)
 - 2) PPG Paints Pitt-Tech Plus EP DTM Industrial Primer, 90-108.
 - 3) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer. (MPI #107)

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Sacrificial Anti-Graffiti Coating: Clear, wax emulsion for coating porous or painted surfaces; capable of being removed from substrate with only hot water.
 - 1. Location: As indicated on Drawings.
 - 2. Products:
 - a. DryWired; Anti-Graffiti: www.drywired.com/#sle.
 - b. Tex-Cote LLC; Sacrificial Graffiti Gard System: www.texcote.com/#sle.
- C. Patching Material: Latex filler.
- D. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Masonry:
 - 1. Veirfy existing surface has not been clear-coated.
 - 2. Remove effloescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 3. Prepare surface as recommended by top coat manufacturer.
 - 4. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.
- G. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
 - 2. Prepare surface according to SSPC-SP 2.
- H. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 Commercial Blast Cleaning. Protect from corrosion until coated.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 099113

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**SECTION 099123
INTERIOR PAINTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Materials for backpriming woodwork.

1.02 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 033511 - Concrete Floor Finishes: Densifiers used on concrete flooring in detention areas.
- C. Section 099113 - Exterior Painting.
- D. Section 099600 - High-Performance Coatings.

1.03 REFERENCE STANDARDS

- A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, full product name and catalog number, and general product category (e.g., "alkyd enamel").
 - 2. MPI product number, if applicable (e.g., MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

1. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
 2. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- B. Paints:
1. Behr Process Corporation: www.behr.com/#sle.
 2. Diamond Vogel Paints: www.diamondvogel.com/#sle.
 3. PPG Paints: www.ppgpaints.com/#sle.
 4. Rodda Paint Co: www.roddapaint.com/#sle.
 5. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
 2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
 5. Supply each paint material in quantity required to complete entire project's work from a single production run.
 6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 016116.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Sheens: Provide the sheens specified; where sheen is not specified in the Project Manual or on the Drawings, sheen will be selected later by Architect from the manufacturer's full line.

2.03 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board.
1. Two top coats and one coat primer.
 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, 141, or 142.
 - a. Products:
 - 1)
 - 2) PPG Paints Copper Armor Interior Latex, 29-1510 Series, Semi-Gloss. (MPI #141)
 - 3) Sherwin-Williams Scuff Tuff, Semi-Gloss, S26W00051. (MPI #141)
 3. Top Coat Sheen:
 - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Medium Duty Vertical: Including steel surfaces not indicated to receive High Performance Coatings.
1. Refer to Section 099600 - High-Performance Coatings for interior substrates to receive high performance coating systems, including hollow metal doors and frames and other steel surfaces.
 2. Two top coats and one coat primer.

3. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153, or 154.
 - a. Products:
 - 1) Behr Premium Interior/Exterior Direct-To-Metal Semi-Gloss [No.3200]. (MPI #153)
 - 2) PPG Paints Advantage 900 Interior/Exterior Styrene Acrylic, 919-10 Series, Semi-Gloss. (MPI #153)
 - 3) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss. (MPI #153)
 4. Top Coat Sheen:
 - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
- C. Transparent Finish on Concrete Floors.
1. 2 coats sealer.
 2. Location: Service areas (Electrical, janitorial, mechanical, etc. rooms.)
 3. Sealer: Water Based Sealer for Concrete Floors; MPI #99.
 - a. Products:
 - 1) Behr Premium Wet-Look Sealer Low-Lustre [No.986]. (MPI #99)
 - 2) PPG Paints Perma-Crete Plex-Seal WB Interior/Exterior Clear Sealer, 4-6200XI, Satin. (MPI #99)
 - 3) Sherwin-Williams H&C Clarishield Water-Based Wet-Look Concrete Sealer. (MPI #99)
 4. Sealer Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
 - a. Products:
 - 1) Behr Paint Premium Plus Interior All-in-One Primer, 75. (MPI #149)
 - 2) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI. (MPI #149)
 - 3) Sherwin Williams ProMar 200 Zero V.O.C. Primer; B28W02600. (MPI #149)
 2. Interior Rust-Inhibitive Water Based Primer; MPI #107.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 3. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.

- E. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- D. Sand wood and metal surfaces lightly between coats to achieve required finish.
- E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 099123

**SECTION 099600
HIGH-PERFORMANCE COATINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. High performance coatings. Including:
 - 1. Inmate Areas D: Walls, doors, hollow metal door and window frames.
 - 2. Lobby stair risers.
 - 3. Walkway between Jail and Vestibule C107 F.
 - 4. Exterior and interior hollow metal door frames and doors
- B. Surface preparation.

1.02 RELATED REQUIREMENTS

- A. Section 099113 - Exterior Painting.
- B. Section 099123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

- A. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2023.
- B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- D. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- E. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- F. SSPC-SP 13 - Surface Preparation of Concrete 2018.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
 - 1. Manufacturer's name, complete product name and catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47), as applicable.
 - 3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.

1.05 MOCK-UPS

- A. See Section 014000 - Quality Requirements for general requirements for mock-ups.
- B. Locate where directed.
- C. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.
- C. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.
- D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- E. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide high performance coating products from the same manufacturer to the greatest extent possible.
- B. High-Performance Coatings:
 - 1. AkzoNobel; <https://www.akzonobel.com/>
 - 2. Dow: www.dow.com/#sle.
 - 3. PPG Paints: www.ppgpaints.com/#sle.
 - 4. Sika Corporation: www.sikafloorusa.com/#sle.
 - 5. Sherwin-Williams Company: www.protective.sherwin-williams.com/industries/#sle.
 - 6. Tnemec Company, Inc: www.tnemec.com/#sle.
 - 7. Substitutions: Section 016000 - Product Requirements.

2.02 TOP COAT MATERIALS

- A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
- B. Epoxy Coating for Detention Areas:
 - 1. Location: Detention Area including walls, doors, hollow metal door and window frames,
 - 2. Number of coats: Two.
 - 3. Top Coat(s): Epoxy-Modified Latex; MPI #115, #215.
 - a. Sheen: Gloss.
 - b. Products:
 - 1) AkzoNobel; Devoe High Performance Coatings, Tru Glaze WB 4426 Water Borne Epoxy 4426/4420.
 - 2) PPG Paints; Aquapon WB EP Two-Component Water-Borne Epoxy, 98E-1/98E-98 Series, Gloss: www.ppgpaints.com/#sle. (MPI #115)
 - 3) Sherwin-Williams; Pro Industrial Water Based Catalyzed Epoxy: www.protective.sherwin-williams.com/#sle. (MPI #115)
 - 4. Primer: As specified under "PRIMERS" below and as recommended in writing by top coat manufacturer for specific substrate.
- C. Urethane Coating for interior and exterior doors outside of detention area:
 - 1. Number of Coats: Two.
 - 2. Locations:
 - a. Lobby stair Riser
 - b. Walkway between Jail and Vestibule C107 F.

- c. Exterior and interior hollow metal doors and frames.
- 3. Top Coat(s): Polyurethane, Water Based, One-Component.
 - a. Sheen: Gloss.
 - b. Products:
 - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Urethane: www.protective.sherwin-williams.com/#sle.
 - (a) Primer: {CH#131962} and as recommended in writing by top coat manufacturer for specific substrate.
 - 2) Tnemec Company, Inc; Series 297 Enviro-Glaze: www.tnemec.com/#sle.
 - 3) Or equivalent product by one of approved manufacturers.
- 4. Primer: As specified under "PRIMERS" below and as recommended in writing by top coat manufacturer for specific substrate.

2.03 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.
 - 1. Block Filler, Latex; MPI #4.
 - a. Products:
 - 1) PPG Paints; Speedhide Masonry Hi Fill Latex Block Filler, 6-15XI: www.ppgpaints.com/#sle. (MPI #4)
 - 2) Sherwin-Williams; Heavy Duty Block Filler: www.protective.sherwin-williams.com/#sle. (MPI #4)
 - 3) Sherwin-Williams; PrepRite Interior/Exterior Block Filler: www.protective.sherwin-williams.com/#sle. (MPI #4)
 - 4) Or equivalent product by one of approved manufacturers and approved in writing by top coat manufacturer for specific substrate.
 - 2. Rust-Inhibitive, Water Based; MPI #107.
 - a. Use:
 - 1) Use with epoxy modified latex top coat on metal substrates.
 - 2) Use with single-component water-based urethane top coat.
 - b. Products:
 - 1) PPG Paints; Pitt-Tech Plus Interior/Exterior Waterborne Acrylic Primer Finish EP DTM Industrial Enamel, 90-1908: www.ppgpaints.com/#sle. (MPI #107)
 - 2) Rust-Oleum Corporation; HIGH PERFORMANCE ROC Prime: www.rustoleum.com/#sle. (MPI #107)
 - 3) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer: www.protective.sherwin-williams.com/#sle. (MPI #107)
 - 4)
 - 5) Or equivalent product by one of approved manufacturers and approved in writing by top coat manufacturer for specific substrate.
 - 3. Alkali Resistant, Water Based; MPI #3.
 - a. Use:
 - 1) Use with epoxy modified latex top coat on CMU substrates.
 - b. Products:
 - 1) PPG Paints; Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series: www.ppgpaints.com/#sle. (MPI #3)
 - 2) PPG Paints; Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI: www.ppgpaints.com/#sle. (MPI #3)
 - 3) Sherwin-Williams; Loxon Concrete and Masonry Primer/Sealer: www.protective.sherwin-williams.com/#sle. (MPI #3)
 - 4) Or equivalent product by one of approved manufacturers and approved in writing by top coat manufacturer for specific substrate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.
- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
 - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
 - 3. Concrete Floors and Traffic Surfaces: 8 percent.
- G. Masonry: Verify masonry joints are struck flush.
- H. Proceed with coating application only after unacceptable conditions have been corrected.
 - 1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

- A. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.
- B. Clean surfaces of loose foreign matter.
- C. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
- D. Remove finish hardware, fixture covers, and accessories and store.
- E. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
 - 3. Clean concrete according to ASTM D4258. Allow to dry.
 - 4. Prepare surface as recommended by coating manufacturer and according to SSPC-SP 13.
- F. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by coating manufacturer.
 - 3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.
- G. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning", and protect from corrosion until coated.

3.03 PRIMING

- A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
- B. Concrete: Prior to priming, patch with masonry filler to produce smooth surface.
- C. Concrete Masonry: Apply masonry filler to thickness required to fill holes and produce smooth surface; minimum thickness of 30 mils.

3.04 COATING APPLICATION

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified.
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.
- D. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.06 PROTECTION

- A. Protect finished work from damage.

END OF SECTION 099600

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SECTION 101400 SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Room and door signs.
- B. Interior directional and informational signs.
- C. Emergency evacuation maps.

1.02 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. When content of signs is indicated to be determined later, 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.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- F. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 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.

1.06 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Flat Signs:
 - 1. APCO Signs, Inc.: www.apcosigns.com/#sle.
 - 2. ASI Sign Systems: www.asisign.com/#sle

3. FASTSIGNS: www.fastsigns.com/#sle.
4. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
5. Poblocki Sign Company: www.poblocki.com/

2.02 SIGNAGE APPLICATIONS

- A. 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.
- B. Room and Door Signs: Provide a sign for every doorway, not including corridors, lobbies, and similar open areas, and in compliance with Owner's signage standards.
 1. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 2. Character Height: Comply with ICC A117.1.
 3. Service Rooms: Identify with the room names, and braille.
 4. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.
- C. Interior Directional and Informational Signs:
 1. Sizes: As indicated on drawings.
- D. Emergency Evacuation Maps:
 1. Allow for one map per elevator lobby.
 2. Map content to be provided by Owner.

2.03 TACTILE SIGNAGE MEDIA

- A. Applied Character Panels: Acrylic plastic base, with applied acrylic machine routed plastic letters, and glass raster braille.
 1. Letter Thickness: 1/16 inch.
 2. Letter Edges: Square.
 3. Subject to prior approval, photopolymer signs may be acceptable.

2.04 NON-TACTILE SIGNAGE MEDIA

- A. Computer-controlled machine-cut calendared vinyl lettering.
- B. Silk Screened Acrylic Plastic Panels: Letters and graphics silk screened onto reverse side of plastic surface.

2.05 ACCESSORIES

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Exposed Screws: Stainless steel for exteriors.
- C. Tape Adhesive: Double sided tape, acrylic foam PVB tape.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Install neatly, with horizontal edges level.
- C. Provide vinyl backer matching sign at signs mounted on glazing.
- D. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- E. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 101400

SECTION 101416 PLAQUES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Plaques.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of plaque sign, indicating style, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings: Indicate dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Package plaque signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Plaques:
 - 1. Bunting Graphics, Inc.
 - 2. Gable Signs
 - 3. Gemini Incorporated.

2.02 PLAQUES

- A. Metal Plaques:
 - 1. Material: Bronze casting with approximately 250 characters.
 - a. Copy of exact wording to be determined during the Submittal Phase.
 - 2. Size: As indicated on drawings.
 - 3. Border Style: As indicated on drawings.
 - 4. Background Texture: As indicated on Drawings.
 - 5. Mounting: Blind studs.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Protect from damage until Substantial Completion; repair or replace damaged items.

CSHQA, Inc.
Agency Review Set
April 21, 2023

Theron W. Ward Judicial Building Remodel and Expansion
Twin Falls, Idaho
Project No.: 21403.000

END OF SECTION 101416

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**SECTION 101419
DIMENSIONAL LETTER SIGNAGE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Dimensional letter signage.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
 - 1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
- D. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Package dimensional letter signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.
- C. Store tape adhesive at a normal room temperature of 68 to 72 degrees F.

1.04 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Dimensional Letter Signs:
 - 1. Gemini Sign Letters: www.geminisignletters.com
 - 2. FASTSIGNS International, Inc: www.fastsigns.com/#sle.
 - 3. Gemini Sign Letters: www.geminisignletters.com
 - 4. Gemini Signs: www.geminimade.com
 - 5. Poblocki Sign Company: www.poblocki.com

2.02 DIMENSIONAL LETTERS

- A. Applications: Building identification and Room Identification, as indicated on Drawings.
 - 1. Use individual metal letters.
 - 2. Mounting Location: Exterior as indicated on drawings.
 - 3. Metal Letters:
 - a. Material: Aluminum casting.
 - b. Thickness: As indicated on Drawings.
 - c. Letter Height: As indicated on Drawings.
 - d. Text and Typeface:
 - 1) Character Font: As indicated on Drawings..
 - 2) Character Case: Upper case only.
 - e. Finish: Brushed, satin.

2.03 ACCESSORIES

- A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that electrical service is correctly sized and located to accommodate dimensional letter signs.
- C. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Protect from damage; repair or replace damaged items.

END OF SECTION 101419

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**SECTION 102113.13
METAL TOILET COMPARTMENTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal toilet compartments.
- B. Urinal screens.

1.02 REFERENCE STANDARDS

- A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling 2018.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall, floor, and ceiling supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Toilet Compartments:
 - 1. All American Metal Corp - AAMCO: www.allamericanmetal.com/#sle.
 - 2. ASI Accurate Partitions: www.asi-accuratepartitions.com/#sle.
 - 3. ASI Global Partitions: www.asi-globalpartitions.com/#sle.
 - 4. General Partitions Mfg. Corp: www.generalpartitions.com/#sle.
 - 5. Hadrian: www.hadrian-inc.com/#sle.
 - 6. Metpar Corp: www.metpar.com/#sle.
 - 7. Substitutions: Section 016000 - Product Requirements.

2.02 MATERIALS

- A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- B. Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel.

2.03 COMPONENTS

- A. Toilet Compartments: Powder coated steel, floor-mounted headrail-braced.
- B. Doors, Panels, and Pilasters: Sheet steel faces, pressure bonded to sound deadening core, formed and closed edges; corners made with corner clips or mitered, welded, and ground smooth.
 - 1. Panel Faces: 20 gauge, 0.0359 inch.
 - 2. Door Faces: 22 gauge, 0.0299 inch.
 - 3. Pilaster Faces: 20 gauge, 0.0359 inch.
 - 4. Reinforcement: 12 gauge, 0.1046 inch.
 - 5. Internal Reinforcement: Provide in areas of attached hardware and fittings. Mark locations of reinforcement for partition mounted washroom accessories.
- C. Door and Panel Dimensions:
 - 1. Thickness: 1 inch.
 - 2. Door Width: 24 inch.
 - 3. Door Width for Handicapped Use: 36 inch , out-swinging.
 - 4. Height: 58 inch.
- D. Pilasters: 1-1/4 inch thick, of sizes required to suit compartment width and spacing.

- E. Urinal Screens: Wall mounted with two panel brackets, and floor-to-ceiling vertical upright consisting of pilaster anchored to floor and ceiling.

2.04 ACCESSORIES

- A. Pilaster Shoes: Formed chromed steel with satin finish, 3 inch high, concealing floor fastenings.
 - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Hollow chrome-plated steel tube, 1 by 1-5/8 inch size, with anti-grip strips and cast socket wall brackets.
- C. Brackets: Polished chrome-plated non-ferrous cast metal.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
 - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof.
- E. Hardware: Satin chrome plated non-ferrous cast metal:
 - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
 - 2. Thumb turn or sliding door latch with exterior emergency access feature.
 - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
 - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
 - 5. Provide door pull for outswinging doors.

2.05 FINISHING

- A. Powder Coated Steel Compartments: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat and two finish coats powder coat enamel.
- B. Color: Single color as selected.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that field measurements are as indicated.
- C. Verify correct spacing of and between plumbing fixtures.
- D. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 102113.13

**SECTION 102600
WALL AND DOOR PROTECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Corner guards.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions and anchorage details.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 PRODUCT TYPES

- A. Corner Guards - Surface Mounted:
 - 1. Basis of Design: Provide product as indicated on Drawings, or a comparable Architect-approved product by one of the following:
 - a. Construction Specialties, Inc: www.c-sgroup.com/#sle.
 - b. Inpro: www.inprocorp.com/#sle.
 - c. Nystrom, Inc: www.nystrom.com/#sle.
 - 2. Material: Type 304 stainless steel, No. 4 finish, 4 feet high.
 - 3. Width of Wings: 1-1/2 inches.
 - 4. Corner: Square.
 - 5. Length: One piece.

2.02 FABRICATION

- A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

3.02 INSTALLATION

- A. Install components in accordance with manufacturer's written instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard as indicated in Materials Key on Drawings.

3.03 TOLERANCES

- A. Maximum Variation From Required Height: 1/8 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.04 CLEANING

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION 102600

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**SECTION 102641
BULLET RESISTANT PANELS**

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. Bullet resistant panels for use in architectural woodwork and gypsum board assemblies.
- B. Related Requirements:
 - 1. Section 092116 - Gypsum Board Assemblies for non-structural steel framing that support bullet resistant panels.
- C. Single Subcontract Responsibilities:
 - 1. Refer to 092116 - Gypsum Board Assemblies for requirements of single subcontract responsibilities for bullet resistant panels installed in conjunction with gypsum board assemblies.

1.03 REFERENCE STANDARDS

- A. Comply with published recommendations of product manufacturers and organizations below, unless more stringent requirements are indicated by the governing codes or the Contract Documents.
 - 1. American Society for Testing and Materials (ASTM):
 - a. ASTM E119 "Standard Test Methods for Fire Tests of Building Construction and Materials."
 - 2. Underwriters Laboratories (UL):
 - a. UL 752 "Standard for Bullet-Resisting Equipment. "

1.04 PREINSTALLATION MEETINGS

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

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, ballistics resistance, and dimensions of individual components.
 - 2. Include fire ratings of units built into fire-rated walls.
- B. Sustainable Design Submittals:
 - 1. Product Data: For adhesives, indicating VOC content.
 - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: For each type of bullet resistant panel showing locations and extent.
 - 1. Include plans, elevations, sections, and attachment details.
- D. Samples for Verification: For each type of the following products:
 - 1. Bullet Resistant Panels: 4 by 4 inches square.

1.06 INFORMATIONAL SUBMITTALS

- A. Sustainable Design Submittals:
 - 1. Environmental Product Declaration: For each product.
 - 2. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
 - 3. Product Ingredient Disclosure: For materials, confirming chemical inventory of products to at least 0.1% (1000 ppm).
- B. Product Certificates: For each type of bullet resistant panel.

- C. Sample Warranty: For special warranty.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store bullet resistant panels in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.08 WARRANTY

- A. Special Warranty: Manufacturer agrees to replace bullet resistant panels unit that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain bullet resistant panels from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Attack Resistance: Provide units identical to those tested for compliance with requirements indicated, and as follows:
1. Ballistics Resistance: Listed and labeled as Level 3 when tested according to UL 752.
B. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
1. Fire-Resistance Rating: One hour.

2.03 BULLET RESISTANT PANELS

- A. Bullet Resistant Fiberglass Panels: Fabricated from rigid opaque fiberglass material.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Armortex; Armortex O.F. 300 Opaque Fiberglass, or a comparable product by another qualified manufacturer.
2. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated, but not less than 48 by 96 inches.
3. Sheet Thickness: Thickness required to comply with performance requirements, but not less than 1/2 inch.
4. Height: 8 feet minimum, unless otherwise indicated.
5. Trim and Joint Materials: Same material as bullet resistant fiberglass panels.
6. Mounting: Adhesive and fasteners.

2.04 MATERIALS

- A. Fiberglass Panel Materials: Fiberglass panels shall be manufactured from multiple layers of starch-oil woven roving ballistic grade fiberglass cloth with thermoset polyester resin, and compressed into flat rigid sheets. The production technique and materials used shall provide the controlled internal delamination to permit capture of a penetrating projectile.
B. Steel Screws: Steel drill screws complying with ASTM C1002, unless otherwise recommended by bullet resistant panel manufacturer.
1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick, unless otherwise recommended by bullet resistant panel manufacturer.
C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers, unless otherwise recommended by bullet resistant panel manufacturer.
D. Adhesive: As recommended by bullet resistant panel manufacturer.
1. Adhesives shall have a VOC content of 70 g/L or less.

2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," CDPH standard method version 1.2.

2.05 FABRICATION

- A. Fabricate bullet resistant panels according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.
- B. Examine architectural woodwork framing and wall framing to which bullet resistant panels will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Installation Quality: Install bullet resistant panels according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, or other defects.
- B. Panels: Panels shall be fastened with steel screws or bolts, unless otherwise required by manufacturer. Method of application shall maintain the bullet resistive rating at junctures with the concrete floor slab, concrete roof slab, bullet resistive door frames, bullet resistive window frames, and all required penetrations.
- C. Joints: All joints shall be reinforced by a back-up layer of bullet resistive material. The bullet resistance of the joint, as reinforced, shall be at least equal to that of the panel. The minimum width of the reinforcing layer shall be 4-inches; 2-inches on each panel or a 2-inch minimum overlap.
- D. Height: Install bullet resistant panels in locations and to installation heights indicated on Drawings. If not indicated on Drawings, install to heights indicated below:
 1. Architectural Woodwork: Install panels full height of cabinet or casework, from finished floor to top of cabinet or casework.
 2. Partitions: Install panels from finished floor to 8 feet minimum above finished floor.

3.03 CLEANING

- A. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102641

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SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Diaper changing stations.
- C. Utility room accessories.

1.02 RELATED REQUIREMENTS

- A. Section 102813 - Detention Toilet Accessories

1.03 REFERENCE STANDARDS

- A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- C. ASTM C1036 - Standard Specification for Flat Glass 2021.
- D. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
- E. ASTM D5047 - Standard Specification for Polyethylene Terephthalate Film and Sheeting 2017.
- F. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 GENERAL

- A. Commercial Toilet, Shower, and Bath Accessories:
 - 1. AJW Architectural Products: www.ajw.com/#sle.
 - 2. American Specialties, Inc: www.americanspecialties.com/#sle.
 - 3. Bradley Corporation: www.bradleycorp.com/#sle.
 - 4. Georgia-Pacific Professional: www.gppro.com/#sle.
 - 5. Kimberly-Clark Corporation: www.kcprofessional.com/#sle.
- B. Owner will be provide the following toilet accessories for Contractor installation:
 - 1. Paper Towel Dispensers.
 - 2. Soap Dispensers.
 - 3. Toilet Paper Dispensers.
 - 4. Sanitary Napkin Disposal Unit.
 - 5. Automatic Air Freshener Dispenser.:
- C. Utility Room Accessories:
 - 1. Provide products as scheduled on Drawings.
- D. Provide products of each category type by single manufacturer to the greatest extent possible.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Keys: Provide 3 keys for each accessory to Owner; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. PETG Plastic Sheet: ASTM D5047.
- F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- H. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

- A. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - 2. Size: As indicated on drawings.
 - 3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
- B. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by hinged front panel, tumbler lock.
 - 1. Minimum capacity: 250 seat covers.
- C. Grab Bars: Stainless steel, textured surface.
 - 1. Standard Duty Grab Bars:
 - a. Push/Pull Point Load: 250 pound-force, minimum.
 - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - c. Finish: Satin.
 - d. Length and Configuration: As indicated on drawings.

2.05 DIAPER CHANGING STATIONS

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
 - 1. Material: Stainless steel.
 - 2. Mounting: Surface.
 - 3. Minimum Rated Load: 250 pounds.

2.06 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
 - 1. Drying rod: Stainless steel, 1/4 inch diameter.
 - 2. Hooks: Three, 0.06 inch stainless steel rag hooks at shelf front.
 - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 4. Length: Manufacturer's standard length for number of holders/hooks.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.

- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 102800

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**SECTION 104400
FIRE PROTECTION SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

1.02 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide Current Edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.
- C. UL (DIR) - Online Certifications Directory Current Edition.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguishers, Cabinets, and Accessories:
 - 1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
 - 2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
 - 3. Nystrom, Inc: www.nystrom.com/#sle.
 - 4. Potter-Roemer: www.potterroemer.com/#sle.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
 - 1. Class: A:B:C type.
 - 2. Size: 10 pound.
 - 3. Finish: Baked polyester powder coat, red color.
 - 4. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

- A. Cabinet Construction: Non-fire rated.
 - 1. Formed stainless steel sheet; 0.036 inch thick base metal.
 - a. Provide rated cabinets where installed in rated wall assembly.
- B. Cabinet Configuration: Semi-recessed type.
 - 1. Size to accommodate accessories.
 - 2. Projected Trim: Returned to wall surface, with 1-3/4 inch projection, and 1-3/4 inch wide face.
- C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

- D. Door Style: Vertical duo panel with frame.
- E. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.
- F. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, at height indicated on Drawings.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.
- E. Position cabinet signage as indicated on Drawings.

END OF SECTION 104400

SECTION 105113 METAL LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal lockers.

1.02 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Lockers:
 - 1. Art Metal Products: www.artmetalproducts.com/#sle.
 - 2. ASI Storage Solutions: www.asi-storage.com/#sle.
 - 3. List Industries, Inc: www.listindustries.com/#sle.
 - 4. Lockers MFG: www.lockersmfg.com/#sle.
 - 5. Penco Products, Inc: www.pencoproducts.com/#sle.
 - 6. Tennsco Storage: www.tennsco.com/#sle.

2.02 LOCKER APPLICATIONS

- A. Box Lockers: Metal lockers, free-standing for base indicated on drawings.
 - 1. Dimensions: As indicated on Drawings.
 - 2. Configuration: As indicated on Drawings.
 - 3. Fittings: Size and configuration as indicated on drawings.
 - 4. Ventilation: Manufacturer's standard louvers in door panel.
 - 5. Locking:
 - a. Jury Assembly Room Lockers: Built-in key locks with spring bolt action.
 - b. Break Rooms: Padlock hasps, for padlocks provided by Owner.
 - 6. Color: To be selected from manufacturer's full range by Architect.

2.03 METAL LOCKERS

- A. Accessibility: Design units indicated on drawings as 'accessible' to comply with ICC A117.1 and ADA Standards.
- B. Locker Case Construction:
 - 1. Heavy-Duty, Knocked Down Construction: Made of formed sheet steel; metal edges finished smooth without burrs; baked enamel or powder coat finished inside and out.
 - a. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
 - 1) Unperforated Steel Sheet: Commercial Steel (CS), Type B, supplied for exposed applications and complying with ASTM A1008/A1008M and the following:

- (a) Uncoated.
- 2) Body and Shelves: 24 gauge, 0.0239 inch.
- 3) Backs: 24 gauge, 0.0239 inch.
- 4) Base: 18 gauge, 0.0478 inch.
 - (a) Height: 4 inch.
- C. Doors: Channel edge; welded construction, manufacturer's standard stiffeners, grind and finish edges smooth.
 - 1. Door Thickness: 16 gauge, 0.0598 inch, minimum.
 - 2. Form recess for operating handle and locking device.
- D. Latches and Door Handles: Manufacturer's standard.
 - 1. Latching: Manufacturer's standard for locking arrangement selected.
- E. Hinges: Heavy-duty, 5-knuckle type; two for doors under 42 inches high; three for doors over 42 inches high.
- F. Coat Hooks: Stainless steel or zinc-plated steel.
- G. Number Plates: Provide rectangular shaped aluminum plates.
- H. Built-In Key Locks:
 - 1. Built-In Key Lock: Cam lock with 5-pin tumbler keyway, keyed separately and master keyed.
 - a. Key Type: Grooved, with minimum 2-inch by 2-5/8-inch key head for accessible lockers.
 - b. Latch: Spring latch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.
- C. Install lockers plumb and square.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
- E. Install end panels and filler panels.
- F. Install fittings if not factory installed.
- G. Replace components that do not operate smoothly.

3.03 CLEANING

- A. Clean locker interiors and exterior surfaces.

END OF SECTION 105113

**SECTION 111400
PEDESTRIAN CONTROL EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pedestrian gates.

1.02 REFERENCE STANDARDS

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- B. NAAMM AMP 500-06 - Metal Finishes Manual 2006.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide material descriptions, dimensions, and finishes for specified pedestrian control equipment.
- C. Shop Drawings: Provide plans, installation requirements, and any required attachments to this work.
 - 1. Identify standard and handicapped accessible lane dimensions and locations, and mounting of card readers.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate schedule for delivery of units to site when installation is ready to commence.
- B. Store units on pallets, as delivered, in upright position, and following instructions on packaging.
- C. Store units in a dry interior location with temperature, humidity, and dust control.
- D. Use forklift, pallet jack, or equivalent equipment for moving units.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 PEDESTRIAN GATES

- A. Pedestrian Gates Manufacturers:
 - 1. Alvarado Manufacturing Company, Inc: www.alvaradomfg.com/#sle.
 - 2. Automatic Systems: www.automatic-systems.us/#sle.
 - 3. Boon Edam Inc; Winglock Swing: www.boonedam.us/#sle.
 - 4. dormakaba: www.dormakaba.us/#sle.
- B. Waist-High Gate: Fully welded assembly with stainless steel tubing, and in-fill of clear acrylic panel held in place with glazing clips. Refer to drawings for configuration.
 - 1. Basis of Design: Alvarado Manufacturing Company, Inc; SW1000T Motorized Pedestrian Gate: www.alvaradomfg.com/#sle.
 - 2. Passage Width: As indicated on Drawings.
 - 3. Gate Height: 46 inch, nominal.
 - 4. Panel: Cast acrylic, Monolithic (single layer solid) sheet.
 - 5. Panel Width: Custom; as indicated on Drawings.
 - 6. Hinge and Latch Posts: 6.8 inch diameter stainless steel tubing, with round base plates and cover.
- C. Gate Closure: Provide hydraulic closure mechanism to close gate smoothly and that allows for field adjustment.
- D. Gate opens in one direction and does not provide locking hardware, or support use of card readers or activation device integration.

- E. Mechanical Operation: Provide manufacturers standard key lock control on entry side and mechanical push bar on exit side of gate.

2.02 MATERIALS

- A. Stainless Steel Components: Comply with ASTM A666, Type 304 alloy.

2.03 FINISHES

- A. Comply with NAAMM AMP 500-06 for recommendations regarding applying and designating finishes.
- B. Stainless Steel: No. 4 satin finish.
- C. Appearance of Finished Work:
- D. Stainless Steel Finishes:

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates, installation areas and conditions for compliance with requirements for installation tolerances, and other conditions affecting performance of this work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install pedestrian control equipment in accordance with manufacturer's instructions.
- B. Install pedestrian control equipment at locations and with spacing as indicated on drawings.

3.03 CLEANING

- A. Clean pedestrian control equipment and work areas carefully after installation to remove excess caulk, dirt and labels.

3.04 CLOSEOUT ACTIVITIES

END OF SECTION 111400

**SECTION 111900
GENERAL PROVISIONS FOR DETENTION WORK**

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. This Section includes the responsibilities for a single-source Detention Equipment Contractor for Detention Work.
- B. Detention Work required by, but not specified in, this Section work includes the following:
 - 1. Section 07 92 10 – Security Joint Sealants
 - 2. Section 11 19 08 – Security Glazing
 - 3. Section 11 19 13 – Detention Hollow Metal Door Frames
 - 4. Section 11 19 50 – Detention Ceiling Panel Systems
 - 5. Section 11 19 53 – Detention Door Hardware
 - 6. Section 11 19 63 – Detention Equipment and Furnishings
 - 7. Section 11 19 93 – Tamper Resistant Fasteners

1.03 QUALITY ASSURANCE

- A. Construction Manager shall furnish detention equipment as described in these sections, and shall coordinate this equipment with the manufacturers, fabricators, installers, and with work by other subcontractors working on the project. Questions on the detention equipment must be directed to the Detention Equipment Contractor before being directed to the Construction Manager, Architect/Engineer or Owner.
- B. Materials required for installation by the Construction Manager may be provided by any of the detention equipment manufacturers included in the Project Manual. The Construction Manager shall receive the materials and assume complete responsibility for the coordination, erecting, installation and performance and warranty of such work.
- C. The Construction Manager's Representative shall provide regular on-site inspection of work being done by detention equipment installers.
 - 1. The representative shall keep a complete log of activities on the project. Dates, times, instructions given and to whom, relating to the installation and proper operation of the system.
 - 2. The representative shall participate in the final inspection of the work and Architects Final Punch Out of all material and equipment in this scope.

1.04 CONSTRUCTION MANAGER - COORDINATION

- A. Coordinate detention work to ensure efficient and orderly installation of each part of detention work. Coordinate detention work that depends on each other for proper installation, connection, and operation.
 - 1. Develop special procedures required for coordination of detention work.
 - 2. Coordinate installation of different detention components to ensure maximum accessibility for required maintenance, service, and repair.
 - 3. Coordinate provisions to accommodate detention work scheduled for later installation.
- B. Coordinate selection of detention products for compatibility.
- C. Assemble and coordinate Shop Drawings for detention work provided by separate entities responsible for detention work. Submit detention work submittals simultaneously as a group along with applicable Coordination Drawings.

- D. Coordinate installation of anchorages and embedments for detention work. Obtain and distribute, to parties involved, 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.
 - 1. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing detention work to comply with indicated requirements.
- E. Coordinate protection of detention work both before and after installation.
- F. Coordinate preparation of Project Record Documents for detention work and integrate information from entities responsible for detention work to form one combined record.
- G. Coordinate preparation of operation and maintenance manuals for detention work and integrate information from entities responsible for detention work to form one combined record.

1.05 OWNER TRAINING AND MATERIALS

- A. The object of the provided training materials and instruction periods shall be to communicate a total understanding of operations and maintenance of all detention equipment included in the work. Coordinate with the Owner to review materials and instruction periods, to assure Owner instruction and information requirements will be met. Obtain approval prior to scheduling training sessions.
- B. Provide a representative approved by the Owner, who is knowledgeable in operation of detention equipment, and who has thorough knowledge of its mechanisms, for an on-site instruction and training period involving Owner's designated personnel. Representative must be capable of training personnel in the adjustment and operation of detention equipment including pertinent safety requirements, and instructing maintenance personnel in its operation, repair, and upkeep. Instruction shall be given during the first work week after the system has been accepted and turned over to the Owner for regular operation, except if detention equipment adjustment and/or repairs are required for its use. In such cases, training sessions are not to occur until such adjustments and/or repairs are satisfactorily completed. Do not exceed five eight-hour days in length for the total of on-site instruction and training period.
- C. Provide an on-site training period. This training period shall not exceed 1 day in length and shall be attended by staff members selected by the Owner. Assume ten (10) Owner staff members.
 - 1. At a minimum the training program shall be subdivided into the following Training Modules:
 - a. Facility Operational and Design Philosophy:
 - 1) Floor plans and traffic patterns for staff and inmates
 - 2) Operational philosophy of the control rooms
 - 3) Design philosophy of the various security system components and their interface.
 - b. Operation of the Security System:
 - 1) Operational characteristics and features and functions of all locks, sliding devices and their power source.
 - c. Trouble Shooting, General Maintenance, Equipment Adjustments, Repair and Replacement of Security System Components:
 - 1) Locks, locking device closers, door position switches, etc.
 - 2. At the conclusion of the Operation of the Security System and Trouble Shooting and Maintenance Training Modules, each trainee will be given a performance-based assessment on that module in order to determine his / her mastery of each training module.
 - 3. The Construction Manager shall record each training module. The recording shall be structured for easy reference by the facility's training staff for future use.

4. The recording shall include the entire presentation by the DEC. The trainer shall introduce each major security training module and by means of a flip chart show each sub-component to be covered next. As a part of the turnover of the training tapes the DEC shall prepare a Training Index denoting the location on the tape where each training section begins and ends.
 5. Provide narration for the recorded training sessions after the training has taken place. Provide professional narration and editing so that content is easily understood.
- D. During the warranty period, if significant changes or modifications take place in the equipment or system, additional instruction shall be provided at no cost to the Owner (unless such changes or modifications are Owner initiated) to acquaint the operating personnel with the changes or modifications.
 - E. Provide electronic operating / maintenance manuals for each of the above referenced sections. Include complete listing of spare parts furnished under detention equipment work (with re-order part numbers and re-order procedures), a list of contact persons (including addresses, phone numbers) for both routine and emergency advice, and a schedule for all maintenance activities required for each appropriate item provided.

1.06 SHAKEDOWN PERIOD

- A. The Detention Equipment Contractor shall coordinate with the Construction Manager to establish a shakedown period for the detention work. The shakedown period shall be a minimum of 5 days and shall be completed after substantial completion.
- B. Prior to initiation of the shakedown period, all work related to and supporting the detention material shall be completed.
- C. The Construction Manager shall maintain a log of all anomalies, malfunctions, and repairs encountered during the shakedown period. The log shall be submitted to the Architect for assessment at the conclusion of the shakedown period.
- D. Training of the Owner's staff shall occur after substantial completion.

1.07 WARRANTY

- A. Refer to Construction Manager's Warranty in Section 017800 - Closeout Submittals.

1.08 SUBMITTALS

- A. Make submittals in accordance with the requirements and timelines stated in Division 01 and the following Sections.
- B. Submit operation and maintenance manual outline/table of contents for review and approval at the same time as packages 1, 2, 3, 4 & 5 are delivered to the Architect.
- C. Submittals for work in Sections 11 19 00 through 11 19 99, shall be submitted as complete composite package by the Construction Manager. Partial or incomplete packages will be rejected. Packages shall be delivered to the Architect at the same time in accordance with the approved submittal schedule.
- D. The Composite Submittal package contents are summarized below. See the submittal paragraph in all sections for specific information required to be submitted under each specification section.
 1. Security Glazing (Section 11 19 08)
 2. Detention Hollow Metal Doors and Frames (Section 11 19 13)
 3. Detention Door Hardware (Section 11 19 53)
 4. Detention Ceiling Panel Systems (Section 11 19 50)
 5. Detention Equipment and Furnishings (Section 11 19 63)
 6. Tamper Resistant Fasteners (Section 11 19 93)
 7. All other specifications listed under the DEC's Scope of Work.

1.09 SPARE PARTS

- A. Provide quantities as indicated in Division 01 specifications.

- B. Deliver to location directed by Owner, cartoned to provide protection during transit and storage. Obtain receipt when delivered
- C. Spare parts and extra stock will be retained by the owner and will not be released for use in installation

PART 2 PRODUCTS (NOT USED)

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 detention work.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of detention work connections before detention work installation.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of detention work.
- B. Inspect built-in and cast-in anchor installations before installing detention work to verify that anchor installations comply with requirements. Prepare inspection reports.
 - 1. Where inspections indicate that anchors do not comply with specified requirements, reinspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- C. Verify locations of detention work with those indicated on Coordination Drawings.

3.02 FIELD QUALITY CONTROL

- A. Observe field welding of detention work and anchorages.
- B. Verify that detention work is installed and connected according to the Contract Documents.
- C. Verify that electrical wiring installation complies with manufacturer's submittal and written installation requirements in Division 26 and Division 28 Sections.
- D. Observe startup service of detention work.
- E. Observe installation and startup checks of detention work according to manufacturer's written instructions.
- F. Inspect installed detention work to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
 - 1. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
 - 2. Prepare field quality-control certification that states installed detention work and its installation complies with requirements in the Contract Documents.
- G. Testing: After installing detention work and after electrical circuitry has been energized, test detention work for compliance with requirements.
 - 1. When testing reveals detention work not in compliance with requirements, perform additional random testing to determine extent of noncompliance.
 - 2. Where test results indicate that detention work does not comply with specified requirements, retest after repairs or replacements are made.
 - 3. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work.

END OF SECTION 111900

**SECTION 111908
SECURITY 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. This Section includes the following:
 - 1. Security glazing.
 - 2. Glazing accessories.
 - 3. Tinting film.
- B. Related Sections include the following:
 - 1. Division 11 Section "General Provisions for Detention Work"
 - 2. Division 11 Section "Detention Hollow Metal Doors and Frames"
 - 3. Division 08 for non-security glazing

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM F1915 (current edition): Test Method for Glazing for Detention Facilities
 - 2. ASTM F1233 (current edition): Test Method for Security Glazing Materials and Systems
- B. National Institute of Justice (NIJ)
 - 1. NIJ - 0108.01: Ballistic Resistant Protective Materials
- C. H.P. White Test Procedures
 - 1. H.P. White TP.0500 Forced entry/Ballistic standard
- D. Walker, McGough, Foltz, and Lyerla (WMFL)
 - 1. WMFL (Levels 1-3) forced entry procedures plus ballistics.
- E. Federal Specifications (FS)
 - 1. FS TT-S-230A: Sealing Compound, Synthetic rubber base, single component, chemically curing for caulking, sealing and glazing in building construction
 - 2. FS TT-S-00230: Sealing compound, Elastomeric type, single component (for caulking, sealing, and glazing in buildings and other structures.
 - 3. FS MIL-P-46144: Polycarbonate and plastic sheet standards
- F. National Glass Association (NGA)
 - 1. GANA: Glazing Manual
 - 2. GANA: Sealant Manual
 - 3. AAMA (Architectural Aluminum Manufacturer's Association) AAMA-800 Sealant Manual, latest edition.

1.04 SUBMITTALS

- A. Product Data: For each security glazing type and glazing material. Include type of materials, thickness, method of test and performance.
- B. Samples:
 - 1. Submit 2 each, 12inch square samples of each type of glazing required.
 - 2. Submit 3 each, 12 inch long samples of each type of glazing sealant and gasket required.
 - 3. Submit samples of interior applied, tinted "films" being considered for glazing. Apply to 12" x 12" samples of glass.
 - 4. Provide full size sample of glazing type and glazing materials for the detention window sample. Coordinate size and requirements with the detention window manufacturer.
- C. Certification by Manufacturer: That products supplied complies with performance requirements specified.

- D. Product Test Reports: Showing compliance with specified requirements.
- E. Maintenance Data: Covering cleaning and protection requirements.
- F. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in the manufacture of security glass, types as specified, with minimum documented (5) years' experience.
- B. Installer Qualifications: Engage an experienced Installer who has specialized in installing security glazing similar to that required for this Project.
- C. Provide compliance with International Building Code, Current Edition.
- D. Certified Safety Glazing: Category II products complying with test requirements of 16 CFR 1201 and ANSI Z97.1, certified by Safety Glazing Certification Council, and permanently labeled.
- E. Ballistics-Resistant and Forced-Entry Resistant Performance: Provide products identical to those tested for compliance with requirements indicated per tests specified for specific glazing types.
 - 1. Have tests performed by qualified independent testing agency.
 - 2. Testing Agencies: Subject to compliance with requirements, acceptable testing agencies are:
 - a. ETL Testing Laboratories, Inc.
 - b. H. P. White Laboratory, Inc.
 - c. Underwriters Laboratories, Inc.
 - d. Warnock-Hersey International, Inc.
 - e. Wiss, Janney, Elstner Associates, Inc.
- F. Test data shall have been performed within the past five (5) years and shall be submitted with the shop drawing submittal.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.07 PROJECT 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.

1.08 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Manufacturer's standard form, made out to Owner and signed by manufacturer, in which manufacturer agrees to furnish replacements for units that deteriorate from normal use by developing defects attributable to the manufacturing process, within warranty period.
- C. Warranty Period: Five (5) year 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. Laminated Glass Clad Polycarbonate and Laminated Polycarbonate Products:
 - a. Global Security Glazing, Selma, AL.
 - b. Oldcastle Building Envelopes, Santa Monica, CA
 - c. McGrory Glass, Inc., West Deptford, New Jersey
- B. For each glass assembly installed, maximum overall warpage allowed as follows. The term warpage shall include bow, cup and twist. In measuring the amount of warp present in a glass unit, the following method shall be use: Bow, cup and twist shall be measured by placing a straightedge, taut wire or string on the suspected concave face of the glass at any angle (i.e., horizontally, vertically, and diagonally), with the glass in its installed position. The measurement of bow, cup and twist shall be made at the point of maximum distance between the bottom of the straightedge, taut wire or string and the face of the glass.
 1. For length of span up to 36 inches: 0.063 inches.
 2. For length of span 36 inches to 48 inches: 0.093 inches.
 3. For length of span 48 inches to 60 inches: 0.141
 4. For length of span over 60 inches: 0.187 inches.

2.02 SECURITY GLAZING TYPES

- A. Security Glazing Types: Provide types of units fabricated of the glazing products indicated with the security performance specified.
- B. SG-01 – Basis of Design = Global Security Glazing, Model MPC 375 – 3/8 inch (2-Ply) Lexgard
 1. Laminated Polycarbonate with mar-resistant coating on exposed surfaces.
 2. Nominal thickness = 3/8 inch.
 3. Performance testing for forced entry: ASTM 1915 Grade 3 (20-minute attack rated).
 4. Security Level 1 (Refer to Drawings for locations).
- C. SG-02 - Exterior Insulated Glazing Unit:
 1. Over thickness = 1-1/2 inches
 2. Insulated Glazing unit, General: Preassembled units consisting of sealed lites of glass separated by dehydrated air space and complying with ASTM E 774 for class CBA units and with requirements specified in this Article.
 - a. Overall Unit thickness and thickness of each lite: Dimensions, if indicated, are nominal and the overall thickness of units are measured perpendicularly from the outer surfaces of the glass lites at unit's edge.
 - b. Sealing system: Dual seal with manufacturer's standard primary and secondary sealants.
 - c. Spacer Specifications: Manufacturer's standard spacer material and construction.
 - d. Corner Construction: Manufacturer's standard corner construction.
 3. Interspace content: Air
 4. Interspace dimension: 3/4 inches
 5. Outdoor Lite: Fully Tempered (FT), condition C (other coated glass) float glass.
 - a. Thickness 1/4 inches
 - b. Tint Color: PPG Solarban 67 (2) Solargray on Clear
 - 1) Visible Light Transmittance (VLT): Maximum 0.30
 - c. Low-emissivity coating sputtered on second surface
 6. Indoor Lite: Laminated Polycarbonate
 - a. Nominal thickness: 3/4 inches
 - b. Performance testing for forced entry: ASTM 1915 Grade 1 (60 minute attack rated).
 - c. Security Level 3 (Refer to Drawings for locations).
- D. SG-F - Fire Rated Security Glazing – (45-120 minute “fire resistance” rated or “fire protective” rated as required).
 1. Nominal Thickness = varies with security level
 2. Performance testing for forced entry: ASTM 1915 (grade varies with security level). Refer to Drawings for ASTM grade / attack rating for specific locations.
 3. Refer to Drawings for fire ratings for specific locations.

4. Basis of Design = Safti-First SuperSecure II-XLS 45-120

2.03 GLAZING ACCESSORIES

- A. General: Provide products of material, size, and shape complying with referenced glazing standard and requirements of manufacturers of glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Glazing Tape: Precured, 100 percent solids, butyl polyisobutylene rubber with internal spacer rod, complying with AAMA 807.1 tape, as described in AAMA 800-86.
- D. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
- E. Backer Rods: Flexible, nonabsorbent, compressible polyurethane foam, either open-cell or nongassing closed-cell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.
- F. Glazing Sealant: Black, neutral-curing silicone complying with ASTM C 920, Grade NS, Type S or M, Class 25, Uses NT, A, G, and O—as applicable to glazing substrates indicated.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine framing for glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - a. Examine framing for glazing, with Installer present, for compliance with the following:
 - b. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - c. Presence and functioning of weep system.
 - d. Minimum required face or edge clearances.
 - e. Effective sealing between joints of glazing-unit-framing members.
 - f. Check for conditions that would void the manufacturer's warranty.
 - g. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean the glazing channel or other framing members to receive glass immediately before glazing. Remove coatings that are not firmly bonded to the substrate.

3.03 INSTALLATION – GENERAL

- A. Expenses carried by the Architect/Engineer, Project Manager and Owner in troubleshooting Security Glass and Glazing problems, caused by inadequate workmanship or other form of poor performance on the part of a contractor, shall be borne by that Contractor.
- B. Comply with combined written instructions of manufacturers of glazing, sealants, gaskets, other glazing materials and tinting film, unless more stringent requirements are indicated, including those in referenced glazing publications.
- C. Glazing channel dimensions, as indicated on Drawings or determined by glazing material thicknesses and by other requirements indicated, provide necessary bite on lites, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

- D. Protect glazing from edge and surface damage during handling and installation. Remove damaged glazing from Project site and legally dispose of off Project site. Damaged glazing are those with edge damage or other imperfections that, when installed, could weaken glazing and impair performance and appearance.
- E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- F. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glazing unit manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- G. Do not block weep holes.
- H. Do not exceed edge pressures stipulated by glazing unit manufacturers for installing lites.
- I. Provide spacers for glazing lites where the length plus width is larger than 50 inches (1270 mm) as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glazing lites. 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 (3-mm) minimum bite of spacers on glazing lites and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- J. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.04 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glazing units, their exposed edges are flush with sightline of stops.
- B. Install tapes continuously. Do not stretch tapes to make them fit opening.
- C. 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.
- D. Do not remove release paper from tape until just before each glazing unit is installed.
- E. Place setting blocks at 1/4 points.
- F. Rest glass on setting blocks and press against tape with sufficient pressure to ensure full contact and adhesion at perimeter.
- G. Place glazing tape on free perimeter of glass in same manner described above.
- H. Install removable stop, avoid displacement of tape, and exert pressure on tape for full continuous contact.
- I. Knife trim excess or protruding tape.
- J. After installation of stops, apply fillet bead of silicone glazing sealant along entire glazing perimeter on both sides of glazing, installed with a substantial "wash" away from the glass, providing a water-tight seal from detergents and cleaning solutions.

3.05 GASKETING

- A. At all fire rated frames, and frames washed with "Water Wash Sprinkler Heads" provide Thermoplastic Rubber Gaskets in lieu of Glazing Tape and sealant cap bead.
 - 1. Product = Advanced Elastomer Systems L.P. – Santoprene Thermoplastic Rubber General Purpose U-Shaped glasket.
 - 2. Gasket sized to fit tightly within glazing pocket, 1/8" from top and glazing stop.

3.06 PROTECTION AND CLEANING

- A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. 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 build-up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.
- E. Wash both sides of glazing not more than 4 days before inspection for Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 111908

**SECTION 111913
DETENTION 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. This Section includes the following:
1. Detention swinging hollow metal doors.
 2. Detention hollow metal frames.
 3. Detention hollow metal sidelight frames.
 4. Detention hollow metal borrowed-light frames.
- B. Related Sections include the following:
1. Division 5 Section for Metal Fabrications
 2. Division 07 Section for Security Joint Sealants
 3. Division 9 Section for Painting
 4. Division 11 Section for General Provisions for Detention Work
 5. Division 11 Section for Detention Enclosures
 6. Division 11 Section for Detention Hardware
 7. Division 11 Section for Security Glazing
 8. Division 11 Section for Tamper Proof Metal Fasteners
 9. Division 26 for Electrical
 10. Division 27 for Communications
 11. Division 28 for Electronic Safety and Security

1.03 PERFORMANCE REQUIREMENTS

- A. Detention doors and frames for this Contract shall be constructed as specified and to meet the following tests. An independent testing laboratory shall perform the tests described below, with data attesting to construction of the door and frame. Test data shall have been performed within the past five (5) years and shall be submitted with the shop drawing submittal.
1. Doors tested in accordance with Standard UL-752, "Bullet Penetration".
 2. Doors tested in accordance with ASTM F 1450, "Door Assembly Impact Test".
 3. Doors tested in accordance with ASTM F 1450, "Door Static Load Test".
 4. Doors tested in accordance with ASTM F 1450, "Door Rack Test".
 5. Doors tested in accordance with Methods E152, Standard UL-10 (B), or Methods NFPA 252, "Door Assembly Fire Test".
 6. Doors tested in accordance with ASTM F 1450, "Door Edge Crush Test".
 7. Doors tested in accordance with NAAMM HMMA 863-98, "Removable Glazing Stop Test".
 8. Frames tested in accordance with ASTM F1592, "Standard Test Methods for Detention Hollow Metal Vision Systems"

1.04 SUBMITTALS

- A. Make submittals in accordance with the requirements of Division 1 and Section 11 19 00. An asterisk (*) indicates items required in a composite package. See Section 11 19 00 for a summary list of composite submittal packages
- B. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of detention door and frame specified.
- C. Shop Drawings: For detention doors and frames. Include conditions at openings, details of construction, dimensions of profiles, and details of joints and connections. Show anchorage and accessories. Identify each detention door and frame using same reference numbers for openings as those on Drawings.

- D. Coordination Drawings: Drawings of each opening, including detention door and frame, drawn to scale and coordinating detention door hardware. Show the following:
 - 1. Locations, dimensions, and profiles of detention door hardware reinforcements.
 - 2. Locations and installation details of detention door hardware.
 - 3. Elevations of each detention door design type showing dimensions, locations of detention door hardware, and preparations for power, signal, and control systems.
 - 4. Details of each detention frame type.
 - 5. Floor plan indicating the sides of glazed frames and doors where applied glazing stops are intended to be set.
 - 6. Provide drawing showing locations of all conduits and connections for electrical and electronic cabling with the door frame and door. Consolidate locations of cabling where practical.
- E. Samples:
 - 1. Door: 1'-0" x 1'-0" corner section with hinge mortise and reinforcement showing internal construction.
 - 2. Frame: 1'-0" x 1'-0" corner section showing welding of head to jamb. Include hinge mortise, reinforcement and plaster guard in one rabbet, and glazing stop applied as specified in the opposite rabbet. Glazing stop shall be applied in both head and jamb section to show corner joint.
 - 3. Samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the manufacturer. No work represented by the samples shall be fabricated until the samples are approved, and any downgrading of quality demonstrated by the sample can be cause for rejection of the work.
 - 4. Submit sample of frame with fastener that has been puttied and ground smooth, as a sample of workmanship.
- F. Submit metal body putty filler product data.
- G. Submit a listing of each opening that has a "UL" rating required that cannot meet the requirements and must be reviewed as "UC Construction" (Assembly has been constructed with materials and methods equivalent to requirements for labeled construction of the Underwriters' Laboratories). List each reason for each door / frame which will not allow the ratings.
- H. Identify each fire door and frame with UL Labels within a written report, indicating applicable fire rating. Provide UL labels and to the Owner / User in a binder of labels cross-referenced to opening numbers in lieu of being permanently affixed to doors and frames. UL Certificate of Inspection indicating that each assembly has been constructed with materials and methods equivalent to requirements for labeled construction of the Underwriters' Laboratories may be accepted in lieu of labeling if labeling cannot be provided. Submit copies of such certificates to the applicable AHJ.
- I. Certification by Manufacturer: That products supplied complies with performance requirements specified.
- J. Product Test Reports: Showing compliance with specified requirements.
- K. Warranties: Special warranties specified in this Section.

1.05 APPLICABLE REFERENCE STANDARDS

- A. Comply with the following except where more stringent requirements are indicated.
 - 1. AISI 304 "Stainless Steel Sheet".
 - 2. ASTM A29 - Steel Bars, Carbon and Alloy, Hot-Wrought and Cold Finished, General Requirements
 - 3. ASTM A36 "Specification for Structural Steel
 - 4. ASTM A108 - Steel Bars, Carbon, Cold-Finished, Standard Quality
 - 5. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 6. ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.

7. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
8. ASTM A283 - Low and Intermediate Tensile Strength Carbon Steel Plates, Shapes and Bars.
9. ASTM A 1008 "Steel, Sheet, Cold-Rolled."
10. ASTM A501 "Hot-Formed Welded and Seamless Carbon Steel Structural Tubing."
11. ASTM A 1011 "Steel, Sheet and Strip, Hot Rolled"
12. ASTM A569 "Steel, Carbon, (0.15 Maximum, Percent) Hot-Rolled Sheet and Strip, Commercial Quality."
13. ASTM A653A "Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality."
14. ASTM A653M "Steel Sheet, Zinc Coated (Galvannealed) by the Hot-Dip Process, General Requirements."
15. ASTM A1008 - Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
16. ASTM B117 "Method of Salt Spray (Fog) Testing"
17. ASTM C143 "Standard Test for Slump of Hydraulic Cement Concrete"
18. ASTM D1735 "Practice for Testing Water resistance of Coating Using Water Fog Apparatus"
19. AWS D1.1 "Structural Welding Code - Structural Steel."
20. AWS D1.3 "Structural Welding Code - Sheet Steel."
21. HMMA "Hollow Metal Manufacturers Association", unless otherwise specified.
22. HMMA-863 Detention Hollow Metal Guide Specification, as modified herein.
23. NFPA 80 "Fire Doors and Windows"

1.06 QUALITY ASSURANCE

- A. Detention Equipment Contractor (DEC) Qualifications
 1. General: Refer to Section 11 19 00.
- B. Provide detention hollow metal work manufactured by a single firm specializing in the production of this type of work.
- C. Installation shall be under supervision of manufacturer-approved personnel.
- D. When a fire resistance classification is shown or scheduled for steel doors and frames, provide fire rated doors investigated and tested as a fire door assembly, complete with type of hardware to be used. Identify each fire door with recognized testing laboratory labels, indicating applicable fire rating of steel doors.
- E. Building Code:
 1. Comply with International Building Code (current enforceable edition) and latest edition NFPA requirements.
- F. Door identification label to include: Fire protection rating under positive pressure, minimum latchbolt throw and maximum temperature rise.
- G. Include supplemental "S" label on 20-minute doors and other openings where doorway occurs in a 1-hour rated exit access corridor.
- H. Hardware: Coordinate products used during fire tests meeting International Building Code (current enforceable edition) and latest edition NFPA requirements including component gasket systems for "S" label.
- I. When a fire resistance classification is shown or scheduled for steel doors and/or frames containing components that have not been tested as an assembly, the manufacturer shall construct the door and frame components of the assembly in accord with the requirements of the testing laboratory for the desired fire resistance rating, and certify in writing to the Owner, Authority Having Jurisdiction (AHJ), Contractor and the Architect that the door and frame components have been constructed in accord with the testing laboratory requirements in lieu of label.

1.07 JOB CONDITIONS

- A. Hardware Coordination Conference: See Detention Hardware Section 11 19 53.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle hollow metal work per manufacturer's requirements.

1.09 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the manufacturer and installer agreeing to repair or replace materials furnished under this Section that fail in materials or workmanship within the specified warranty period. Submit the warranty to the Architect for approval.
- C. Warranty Period: In addition to the requirements of the Contract Conditions, DEC shall extend correction period an additional one (1) year from date of substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURER OF DETENTION HOLLOW METAL DOORS AND FRAMES

- A. Acceptable Manufacturers:
1. Trussbilt Inc.; St.Paul, MN
 2. Titan Steel Door
 3. Claborn Manufacturing
 4. Or Approved Equal
- B. Others seeking approval as a Hollow Metal Supplier are to make substitution requests in accordance with the requirements of the Contract, and which include the following:
1. Submit evidence of completed projects within the last five (5) years. Provide a list of contacts at each facility, addresses and phone numbers
 2. Provide a list of all projects in the past five (5) years in which the proposed firm has been involved in litigation with a city, county, state or federal government agency and the status thereof.
 3. Furnish frame corners sections of door and window frame for review. Provide 2-12" corner, sample frames.
 4. Submit copies of welder's certification for all personnel who will perform services on this project.
 5. Submit a full-size corner sample of each type door and frame showing door construction, face stiffening, insulation, and top hinge reinforcements; details of each type of door and frame, performance data in accordance with performance tests specified below.
 6. Submit a statement letter from the Surety Company stating that a 100% Payment and Performance Bond will be supplied if selected as the successful Hollow Metal Assembly Supplier
 7. Submit an independent testing laboratory report certifying all doors, door frames and window frames meet minimum ASTM F1450 (current edition) Grade 1 performance.
- C. Requests shall be considered only from competent and reputable firms who specialize in this particular branch of work and who can demonstrate to the satisfaction of the Architect and Owner that they are fully capable of completing detention equipment work in accordance with requirements. The owner reserves the right to consider each request on merits of material furnished or otherwise at this disposal, and to reject any or all requests which are not in the owner's best interest. The Owner's decision in this matter will be final and incontestable. Hollow Metal Suppliers accepted for bidding on this project will be announced by addendum before bid date. Bids received from others not named by addendum will be deemed non-responsive

D. Material

1. Steel materials for all components of doors and frames must match the type and quality used by the sample door/frame used for the testing certification.
2. Damp conditions and exterior locations: Galvannealed steel for all components of doors and frames.
3. Shower doors: Stainless steel for all components of doors and frames.

2.02 DETENTION HOLLOW METAL DOORS

- A. General Workmanship: Use only materials of size and thickness as indicated which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness; work to dimensions indicated or accepted on shop drawings. Form exposed work true to line and level with accurate corners and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise noted.
- B. Hardware Preparation: Templates, hardware schedules to be furnished by Section 11 19 00 suppliers. Prepare Section 11 19 13 products to accept all required hardware properly.
- C. Painting: Shop paint all metal work, except members or portions of members to be embedded in concrete or unit masonry. Prepare galvanized frames as required to accept paint. Remove scale, rust and other deleterious materials before applying shop coat; comply with Steel Structures Paint Council (SSPC) "SP-3 Power Tool Cleaning (for field welds only) or SP-7 Brush-Off Blast Cleaning" requirements. Immediately after surface preparation, brush or spray on primer in accord with manufacturer's instructions and at a rate to provide total uniform dry film thickness.; use painting methods which will result in full coverage of joints, corners, edges and exposed surfaces.
- D. Applied Glazing Stops: For all types, provide as indicated; form using 12 ga. hot rolled steel sheet except where angle types are required. "Mitered corner" design is required, with fully welded corners to provide a one piece glazing stop is required. Obtain all necessary tolerances for glass and glazing from Section 11 19 08 supplier. Provide to secure to frames using security screws; space 2" from each applied stop corner and uniformly spaced on not greater than 8" between. Drill and tap to receive security screws. Protect inside of frame to assure complete screw penetration when frame grouted full, with continuous mortar boxes. Use of "self-drilling" screws is not allowed.
- E. Coordinate placement of stops with work of Section 11 19 08. Ship frames to project site with stops secured with standard screws. Also, ship security screws (plus 10% spare) in appropriate containers labeled and tagged to match frames. Provide instructions for proper stop installation to the installer of Section 11 19 08 products and, when acceptable, approve such installation in writing.
- F. Welding: Steel and stainless steel components not plant fabricated shall be designed for plug or stitch weld field-welded connections, unless indicated otherwise.
- G. Install metal body putty to all metal to metal joints and/or connections on doors and/or frames, grind smooth and prepare surface for painting.
- H. Welding:
1. Welds to be of type, size and space indicated on drawings. Where not specifically indicated, provide stitch welds a minimum 1-1/2" long, 6" o.c.; plug welds 1/2" diameter, 4" o.c. There must be a minimum of two per side of any opening.
 2. Materials forming corners are to be welded along each line of transition at the corner
 3. Where exposed to view, fill between all welds, grind and finish smooth.
 4. Tack weld all exposed bolts in areas where inmates have access.
 5. Surface hinges and members 6"x 6" or less shall be continuously welded.
- I. Metal Doors: 2" thick with door edges at top, sides and bottom finished flush; also, doors shall be mortised, accurately cut, reinforced internally, drilled and tapped as required for proper secure mounting of door accessories such as food passes, vision panels, locking devices, and all other detention equipment and hardware.

1. Doors shall have no more than 1/8" clearance at sides and tops.
2. Doors shall have bevel at lock and hinge edges so that door will operate without binding.
3. Doors shall be reinforced at corners and elsewhere sufficiently to prevent sagging or twisting under wind loads.
4. Doors shall have face sheets of 12 ga.
5. Reinforcing: Reinforced internally with channels of not less than 1/8" thick material extending full height of door, spaced approximately 4" o.c., spot welded to face sheets 3" o.c. along entire length of each channel; weld to door perimeter reinforcing. :
6. Alternate acceptable internal reinforcing Continuous steel truss design, 28 ga. minimum, resistance spot welded not over 2-3/4" o.c. horizontal, 3" o.c. vertical and welded to face sheets and perimeter reinforcing.
7. Alternate acceptable internal reinforcing: 18 ga. hat-shaped continuous vertical steel stiffeners the full width and height of door, resistance spot welded not over 3" o.c. horizontally and vertically to face sheets and perimeter reinforcing.
8. Perimeter reinforcing: Provide with not less than 1/8" thick channel bending around complete door perimeter welded to face sheets 2" o.c. Do not cut except to allow for hinges, door position switches, lock bolts, closers, strike plates. Return outer edges of face sheets at the edges to a close fit and tack welded 2" o.c. Grind welds smooth.
9. Hinge Reinforcing:
 - a. Mortise: 3/16" x 1-1/2" x 10" steel plate, drilled and tapped at factory for mortised hinges, frame face. Fill spaces between frame face and hinge reinforcement with steel strips welded. Provide additional channel at top hinge of 1-1/2" x 3/4" x 1/8"x 10" long, welded to plate inside edge channel.
 - b. Surface: 3/16" x 10" steel channel.
10. Other reinforcing: Provide all other door reinforcement for surface items such as pulls, lock plates. Door closer reinforcement shall be 12 ga. one piece channel type, 3-1/2" deep by 14" long. Reinforcement for handle type pulls shall be 3/8" x 2" x 12" steel plate.
11. Vision panels, food pass and cuff port openings: Where required, provide factory made openings, reinforced with not less than 1/8" thick material bending around complete opening perimeter welded to face sheets 2" o.c.; grind welds smooth and fill between welds with body putty.
12. Pockets for prison locks: Provide in each door where required on the door schedule. Detention side of pockets shall have not less than 3/16" thick steel plate to protect lock. Provide rabbeted frame around mounting plate for flush finish with door face. Secure cover plates with a minimum of eight security screws. Also, anchor each lock to applicable door in accord with lock manufacturer's instructions and recommendations for particular conditions of installation in each case.
13. Insulation: Insulate doors to reduce metallic ring; completely fill all internal door voids. 6 lb. density, mineral composition, incombustible, moisture resistant, chemically inert sound deadener.
14. Door bottom profiles to interlock with thresholds: Provide for locations where required.
15. Lock Bolt Keepers: Minimum 14 gauge galvanized steel with 1/8" steel back up at lock bolt.
16. Framed Openings Interrupting Door Edges: Reinforce door with a 10 gauge channel along enclosed vertical edge. Frame top and bottom of opening with 10 gauge channels and diagonally reinforce door between continuous vertical reinforcement and door edge.

2.03 DETENTION HOLLOW METAL FRAMES

- A. Metal Frames:
 1. General: Provide of styles as indicated/scheduled and that comply with requirements indicated/specified.
 2. Form plate covers using steel plate in thickness as required. At steel plate covers, accurately form joints and continuously weld; grind to smooth uniform finish.
 3. Fully-welded frame construction required.

4. At frame corners, "miter" or "butt" design required which also is continuously welded on backside, all exposed sides and depth of frame with face side ground smooth for invisible joint.
5. At mullion (either vertical or horizontal) intersections, reinforce joints with concealed "clip" angles (or other acceptable shapes) of the same metal thickness as frames and welded to frame members. Also, at mullion (either vertical or horizontal) intersections, accurately form joints and continuously weld; grind to smooth uniform finish.
6. As shown on drawings, provide all electrical conduit in the frames. Provide separate conduits where audio signal wire is to run in frame.
7. For electrical devices that are not detention equipment hardware but are required in frame, provide properly sized cut-outs for the devices, properly sealed mortar boxes (14 ga. minimum) with access for conduit, and tapped holes for device and/or device cover plate attachment, with internal protection so fasteners seat properly when frame is grouted full.
8. Hinge Reinforcement:
 - a. Mortise: 3/16" x 1-1/2" x 10" steel plate, drilled and tapped at factory for mortised hinges, frame face. Fill spaces between frame face and hinge reinforcement with steel strips welded. Provide additional plate at top hinge of 1-1/2" x 3/16" x 10", welded to inside of frame trim.
 - b. Surface: 3/8" x 1-1/2" x 10" steel plate, provide additional plate at top hinge of 3/16" x 1-1/2" x 10", welded to inside face of frame.
9. Lock bolt keepers: Minimum 14 ga. galv. steel with 1/8" steel backup at lock bolt.
10. Applied glazing stops: Drill and tap to receive security screws. Protect inside of frame to assure complete screw penetration when frame grouted full, with plastic cups or mortar boxes. Use of "self-drilling" screws is not allowed.
11. Floor clips: Minimum 12 gauge angle clips, drilled for expansion bolts, welded to bottom of each jamb. Floor clip shall to be concealed within the frame assembly. Floor clips are required on all sliding and swing door frames.
12. Pockets for prison locks: Provide in each frame where jamb mounted prison locks are used, with min. 3/16" thick rounded edge steel plate cover to protect locking device; secure cover with a minimum of twelve security screws. Anchor locks to frame in accord with lock manufacturer's instructions and recommendations for particular conditions of installation in each case.
13. Provide steel spreaders temporarily attached to the feet of both jambs to serve as a brace during shipping and handling of frames.
14. Pockets for closers: Provide prepared to receive closers, in accordance with manufacturer's requirements.
15. Surface mounted items: Provide 3/8" x 1-1/2" x cont. steel plate. Provide additional 3/16" steel plate at top hinge.
16. Grout Stiffeners: Provide as required to prevent frames from buckling during grouting in the field.
17. No electrical access boxes are to be provided except hardware pockets or communication mortar boxes.

2.04 CLEARANCES AND TOLERANCES

- A. Edge clearances for swinging doors shall not exceed the following:
 1. Swing doors without thresholds – 1/2"
 2. Cell doors - 1/2"
 3. Individual sliding doors - 1/2"
 4. Swing doors with thresholds - as required for installation.
- B. Manufacturing tolerance shall be maintained within the following limits:
 1. Frames for single door or pair of doors: Width, measured between rabbets at the head: Nominal opening width +1/16 in., -1/32 in.. Height (total length of jamb rabbet): Nominal opening height + 3/64 in.. Cross sectional profile dimensions:
 - a. Face: $\pm 1/32$ in.

- b. Stop: $\pm 1/32$ in.
 - c. Rabbet: $\pm 1/32$ in.
 - d. Depth: $\pm 1/32$ in.
 - e. Throat: $\pm 1/16$ in.
 - f. Flatness of large frames: 1/8 in. in 10 ft. of length or width
2. Swinging and sliding door:
- a. Width: $\pm 3/64$ in.
 - b. Height: $\pm 3/64$ in.
 - c. Thickness: 1/16 in.
 - d. Hardware cutout dimensions
 - 1) Template dimensions: 0.015 in. - 0 in.
 - e. Hardware location: $\pm 1/32$ in.
 - f. Bow/ flatness: $\pm 1/8$ in.

2.05 FINISH

- A. After fabrication, doors and frames shall be thoroughly cleaned, degreased, bonderized and provided with one coat of primer.
- B. Shop Applied Primer: Manufacturer's standard rust inhibitive enamel. Verify compatibility with finish coats as specified in Division 9 - Painting. If compatibility is not ascertained during the bidding period, Contractor shall provide primer as specified in Division 9 - Painting.

2.06 ELECTRICAL REQUIREMENTS

- A. Detention hollow metal fabricator shall furnish and install junction boxes and conduit between junction boxes in door frames for electro-mechanical locks, door position switches, and intercom call stations; coordinate special hardware requirements with the Electrical Contractor, Security Electronics Contractor and Detention Equipment Contractor.
- B. See the Detention Hardware Schedule, the Detention Hollow Metal Door Schedules, and Details.

2.07 DETENTION EQUIPMENT ACCESSORIES

- A. Provide accessories, anchorage inserts and security fasteners for a complete, tamperproof installation.
- B. Exposed Security Fasteners:
 - 1. Provide torx head (star design with center pin) security fasteners for anchoring work in exposed detention areas. Comply with specification section 11 19 93.
 - 2. Finish shall match that specified of the item anchored.

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 installation.
- C. Notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Expenses incurred by the Architect/Engineer, Project Manager or Owner in troubleshooting equipment problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.

- B. Install Detention Hollow Metal Doors and Frames in accordance with shop drawings, manufacturer's written installation instructions, and as herein specified.
- C. Place detention hollow metal frames prior to construction of enclosing walls. Set frames accurately in position, plumbed and aligned (using metal shims), and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
- D. Prior to installation, frames shall be checked for size, and swing, and with temporary spreaders removed, corrected for squareness, alignment, twist and plumb. Permissible installation tolerances shall not exceed the following:
 - 1. Squareness + 1/16 in.: Measured on a line, from jamb perpendicular to frame head.
 - 2. Alignment + 1/16 in.: Measured at jambs on a horizontal line parallel to the plane of the face.
 - 3. Twist + 1/16 in.: Measured at opposite face corners of jambs on parallel lines, perpendicular to the plane of the door rabbet.
 - 4. Plumb + 1/16 in.: Measured at jambs on a perpendicular line from the head to the floor.
- E. Install fire-rated frames in accordance with NFPA Standard No. 80.
- F. Grout fill detention hollow metal door and window frame jambs, sill and head sections in all walls. Provide grout openings in detention hollow metal frames where access to fill frames may be restricted due to steel lintels, rough opening or other obstructions.
- G. Touch-up painting of factory finished or factory primed items is the Installer's responsibility.
- H. Fill voids between materials of the detention equipment and embeds or other physical construction with low-mod gel, equal to Sikadur 23, by Sika and paint equipment to match surrounding materials.

3.03 ADJUSTMENT AND CLEANING

- A. Check and readjust Detention Hollow Metal Doors and Frames just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise damaged.
- B. Clean equipment thoroughly prior to Substantial Completion.

3.04 PROTECTION

- A. Protect equipment and finishes until Substantial Completion.
- B. Replace damaged equipment as directed by the Architect.

END OF SECTION 111913

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**SECTION 111950
DETENTION CEILING PANEL 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 Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Non-Acoustical security pan and plank metal ceilings
 - 2. Acoustical security pan and plank metal ceilings
- B. Related Sections include the following:
 - 1. Division 09 for Interior Painting.
 - 2. Division 09 for Epoxy Finishes.
 - 3. Division 11 for "General Provisions for Detention Work"
 - 4. Division 21 for Fire Suppression
 - 5. Division 23 for Mechanical
 - 6. Division 26 for Electrical
 - 7. Division 27 for Security Electronics

1.03 REFERENCE STANDARDS

- A. ASTM A 1008/A 1008M (current editions), Specification for Steel, Sheet and Strip, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability
- B. ASTM A 1011/A 1011M (current editions), Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability
- C. ASTM A 653/A 653M (current editions), Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dipped Process (Commercial Steel)
- D. ASTM A 666 (current edition), Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar
- E. ASTM B 117 (current edition), Standard Practice for Operating Salt Spray (Fog) Apparatus
- F. ASTM D 610 (current edition), Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces
- G. ASTM D 714 (current edition), Standard Test Method for Evaluating Degree of Blistering of Paints
- H. ASTM D 1735 (current edition), Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus
- I. ASTM C 635 (current edition), Standard Specification for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- J. ASTM C 636 (current edition), Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
- K. ASTM C 423 (current edition), Standard Test Method for Sound Absorption and Sound Absorption Coefficient by the Reverberation Room Method
- L. ASTM F 2697 (current edition), Standard Test Methods for Physical Assault on Overhead Horizontal Fixed Barriers for Detention and Correctional Facilities
- M. ASTM E-84 (current edition), Standard Test Method for Surface Burning Characteristics of Building Materials.
- N. AWS D1.3 (current edition), Structural Welding Code for Sheet Metal

- O. ISO 9001 International Standards Organization – Standards for Quality Management
- P. CISCA Guidelines
- Q. Abbreviations:
 - 1. ASTM: American Society for Testing Materials
 - 2. AWS: American Welding Society
 - 3. CISCA: Ceilings and Interior Systems Construction Association

1.04 TESTING AND PERFORMANCE

- A. Fire Performance
 - 1. Acoustical fill flame spread index shall not exceed 15 with smoke developed value not exceeding 5 when tested in accordance with ASTM C 84.
- B. Manufacturer shall submit evidence of ceiling assemblies testing in accordance with ASTM ASTM F 2697 (current edition) for each ceiling type described herein.

1.05 QUALITY ASSURANCE

- A. Manufacturer's Qualifications:
 - 1. Manufacturer shall provide evidence of having personnel and plant equipment capable of fabricating ceiling assemblies of each type specified herein. Manufacturer shall provide current documentation of the number of employees, a listing of their production equipment, and a description of their manufacturing facility.
 - 2. Manufacturers shall be ISO 9001 (current edition) certified and shall be required to present their Certificate of Registration upon request. The manufacturer's registrar shall be nationally recognized and shall provide the manufacturer with periodic factory follow up audits reaffirming the manufacturer's continuing compliance with their written quality program.
 - 3. Manufacturer's production welders shall be qualified under AWS D1.3 and, upon request, shall provide copies of Welders Certifications in accordance with AWS D1.3.
 - 4. Manufacturers shall have a minimum of five (5) years' experience successfully producing security ceiling systems of the types and sizes required in the contract documents. Upon request the manufacturer shall provide a list of successfully completed projects and the dates they were completed.
 - 5. Manufacturers shall have written test reports of their having passed the testing requirements of section 1.4 using their current materials and production processes.
- B. Quality Criteria
 - 1. All ceiling construction shall be in accordance with construction of assemblies which meet the testing requirements of Section 1.4.
 - 2. Fabrication methods and product quality shall meet standards specified herein.

1.06 SUBMITTALS

- A. Submittal Drawings
 - 1. Submit in accordance with Division 01.
 - 2. Provide detailed drawings including: layout of ceiling systems, details of construction, gauges of metal, anchoring details, conditions at openings, installation details and methods, and other data pertinent to the installation, including illustration of sequence of installation to accomplish interlocking panels.
- B. Samples
 - 1. Supply a 1'-0" x 1'-0" section of each ceiling type being specified herein, showing wall mounting members and panel sections.
 - 2. All samples submitted shall be of the production type and shall represent in all respects the minimum quality of work to be furnished by the manufacturer. Any downgrade of quality demonstrated by the samples can be cause for rejection of the work.
- C. Test Reports

1. Manufacturer shall submit to the architect an independent testing laboratory report certifying that ceiling assemblies meet the performance requirements of Paragraph 1.4 and are constructed in accordance with Paragraphs 2.1 of these specifications.
- D. Qualifications
1. Manufacturer shall submit evidence of qualifications as described in section 1.5.

1.07 WARRANTY

- A. All panels shall be warranted by the panel manufacturer from defects in workmanship and quality for a period of ten [10] years from date of substantial completion.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Basis of Design = Trussbilt:
1. Ceiling Types DPC-1 and DPC-1A:
 - a. Trussbilt – “SecureDek”
 2. Ceiling Type DPC-3
 - a. Trussbilt – “TrussDek”
 - b. Kane Manufacturing
 - c. Approved Equal
- B. CONSTRUCTION
1. Ceiling Type DPC-1 and DPC-1A:
 - a. Ceiling Type DPC-1:
 - 1) Suspended Metal Pan Detention Panel Ceiling
 - b. Ceiling Type DPC-1A:
 - 1) Acoustic Suspended Metal Pan Detention Panel Ceiling
 - c. Performance: All ceiling panels shall be tested in accordance with and shall meet or exceed the requirements of ASTM F2697 – Grade 4.
 - d. Ceiling pans: Shall be nominally 24” x 24” (or 24” x 48”) x 1” deep with sloping vertical legs on all four sides. All acoustical pans shall be factory formed and shall be perforated with .080” diameter holes on .220” staggered 45-degree centers.
 - e. When installed, the face of the pans shall rest on the inside surface of the exposed horizontal flanges of the main runner and cross tees. The sloping vertical legs of the pans shall snap-in and lock positively and continuously under the bottom surface of the rectangular bulb of the tee sections, and lock into the perimeter channel by a 20-gauge galvanized hold-down clip, thereby providing a visual concealment barrier without the use of exposed clips or fasteners.
 - f. Main runners and cross tees: Shall conform to the requirements of a system wide, duty classification in accordance with ASTM C635. They shall be a roll-formed double web with rectangular bulb, using A40 galvanized steel, minimum .018” thick, to an overall height of 1½” with a flange width of 15/16”. The structural member will incorporate double lateral rotary stitching to provide a more homogeneous component exhibiting increased columnar and torsional strength. The cross tee shall provide a positive mechanical lock into the main runners and locking splice. When assembled, the system shall carry performance characteristics in keeping with those necessary to achieve a Zone 3 seismic rating.
 - g. Hangers: The main runners shall be supported from the structural ceiling by 12-gauge galvanized, pre-stretched, soft annealed, steel wire hung at points not exceeding 48” on center.

- 1) Compression Struts: Shall be composed of telescoping $\frac{1}{2}$ " diameter and $\frac{3}{4}$ " diameter steel tubing. The $\frac{3}{4}$ " diameter tube shall extend down to rest on the bulb of the main runner. At the other end, a length of $\frac{1}{2}$ " diameter tube is to be telescoped into the top portion of the $\frac{3}{4}$ " diameter tube and screw fastened to it with two (2) No.10 x $1\frac{1}{4}$ " screws so the top of the $\frac{1}{2}$ " diameter tube bears on the structure above and the bottom of the $\frac{3}{4}$ " diameter tube fits snugly upon the bulb of the main runner. A compression strut is required at each hanger wire at a maximum of 48" on center.
 - h. Wall Perimeter channels: Exposed wall perimeter channel shall be of the same material and have the same finish as the suspension system runners. The perimeter channel shall also be roll-formed into a "C" profile to accommodate a 20 gauge hold-down clip, thereby providing a concealed fastener system. Each hold-down clip shall be locked onto perimeter channel with two spring clips.
 - i. Fasteners: Any exposed fasteners shall be a minimum No.10 size, pin Torx®, tamper-proof security screws. Fasteners for securing the wall moldings to the wall shall be furnished by the ceiling manufacturer.
 - j. Acoustical material: The inside surface of all perforated ceiling pans shall be covered with a Class "A" poly-encapsulated fiberglass insulation of sufficient thickness and density to provide an NRC of not less than .90 when tested in accordance with ASTM C 423.
 - k. Lights, HVAC and fire suppression: All light and air units and fire suppression units are to be sized to fit into and trim off full module openings and shall be independently supported from above by the trade requiring the opening.
 - l. Finish: All components of the panel and suspension system visible from the floor side shall have a factory applied finish. Prior to painting, all surfaces shall be cleaned of rust, oil and other impurities by receiving a multi stage pre-treatment consisting of degrease and phosphate coating, clear water rinse and non-chromate sealer and rinse, to condition the surface of the metal to resist and inhibit corrosion and promote paint adhesion. Finish to be applied after perforation to insure coating of the perforated holes. Panels shall be coated with DuPont TGIC Polyester or equal, white powder coat, applied at a minimum of 2 mils thickness (dry). The main runners, cross tees, and wall perimeter channels shall be coated with epoxy white powder matching the ceiling panels
 - 1) In order to prevent removal of zinc galvanizing material from panel surfaces, panels shall not be finish sanded on panel surfaces.
 - 2) All field touch ups and welds shall be spot primed with an epoxy-based primer and final touch up using a manufacturer approved touch up paint matching the original factory finish in color, finish and type.
 - 3) The use of alkyd primers will not be allowed for material attached to the metal panel system.
2. Ceiling Type DPC-3:
- a. Double skin ship-lap joint plank detention panel ceiling system.
 - 1) Performance: All ceiling panels shall be tested in accordance with and shall meet or exceed the requirements of ASTM F2697 – Grade 1.
 - 2) Ceiling panels: Shall be 24 in. wide and supplied in manufacturer's standard lengths of 6 ft, 8 ft.or 10 ft. All acoustical planks shall have factory formed ship-lap edges and shall be perforated with 0.125 in. diameter holes, staggered .218 in. on center for a 29% open area.
 - b. Panel core construction: Panels shall be stiffened using one of the follow core systems:
 - 1) Continuous steel truss design core material, .015 in. minimum, having truncated triangular sections extending continuously from one panel face to the other, spot welded to each face sheet 2.75 in. on center horizontally and 3 in. on center vertically. Core material shall extend full height and width of panel.

- 2) Rolled or formed 1/8 in. steel channels extending full length of panel and continuous from one face to the other, spaced not more than 4 in. on center and spot welded to panel faces not more than 3 in. on center vertically.
- 3) Continuous vertical hat sections, one such hat section welded to each face of the panel, .053 in., with vertical webs no more than 4 in. apart. Hat sections shall be welded to each other at least 6 in. on center on both sides in order to prevent separation.
- 4) All spaces between stiffeners shall be filled with fiberglass or mineral rock wool batt-type material (applies to both acoustic and non-acoustic panels).
- c. Start and ending panels: shall be 0.093 in. minimum thickness, single skinned non-perforated material and shall be cut to size in the field by the installing contractor.
- d. Wall perimeter angles: Shall be formed angles 0.123 in. minimum thickness and punched 16 in. on center for 3/8 in. expansion anchors. Panels shall be welded to the wall angles 1 in. weld 12 in. on center.
- e. Interim Tee supports: Tee supports shall be two wall mounting angles bolted back-to-back using 3/8" – 16 bolts, 24 in. on center.
 - 1) Suspension for Tee supports shall be 3/8 in galvanized threaded rod, bolted to the above structure and the Tee support, 36 in (914 mm) on center.
- f. Fasteners: Any exposed fasteners shall be a minimum No.10 size, pin Torx®, tamper-proof security screws or blind rivets. Wall anchor bolts shall be 3/8 in. diameter (Rawl 5015 or equivalent) and shall be placed 16 in. on center. Anchors for securing the wall moldings to the wall shall be furnished by the ceiling manufacturer.
- g. Lights, HVAC and fire suppression: All light and air units and fire suppression units are to be sized to fit into and trim off full module openings and shall be independently supported from above by the trade requiring the opening.
- h. Finish: After fabrication, all tool marks and surface imperfections shall be filled and sanded as required to make face sheets, vertical edges and weld joints free from irregularities. After appropriate metal preparation, all exposed surfaces of panels shall receive a rust inhibitive primer which meets or exceeds ASTM B117 Salt Spray for 150 hours with a rust grade of not less than 6 as defined in ASTM D610, and ASTM D1735 Water Fog Test for organic coatings for 200 hours with any quantity of #8 blisters but no more than a few #6 blisters as illustrated in ASTM D714.
 - 1) In order to prevent removal of zinc galvanizing material from panel surfaces, panels shall not be finish sanded on panel surfaces.
 - 2) All field touch ups and welds shall be spot primed with an epoxy-based primer and final touch up using a manufacturer approved touch up paint matching the original factory finish in color, finish and type.
 - 3) The use of alkyd primers will not be allowed for material attached to the metal panel system.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE AND HANDLING

- A. Protect panels from damage during transit to job storage.
- B. Inspect panels upon delivery for damage. Minor damage may be repaired provided finish items are equal in respect to new work and acceptable to Architect/Engineer. Otherwise, remove and replace with new material.

3.02 INSTALLATION

- A. General
 1. Install ceiling system using the approved submittal drawings and contract documents. Install using the manufacturer's installation instructions.
 2. Accurately locate partitions, holes, cut outs and verify locations with other trades.
 3. Set closures and steel supports with anchors to suit condition.
 4. Erect true and level with close fitting tolerances.
 5. Bearing at ends shall be a minimum of 1 in.

- B. Fastenings
 - 1. Fasten supporting members to each other and to building construction as detailed or as otherwise required to provide a secure, permanent installation.
 - 2. Where fastening spacings and sizes are not shown, use spacings and sizings of bolts, screws and welds which will develop the full strength of the members before failure occurs in the fastenings and are in accordance with manufacturers testing per ASTM F 2697
- C. Touch-up Painting
 - 1. Immediately after installation, areas where prime or finish coat has been damaged and where welding has occurred shall be sanded smooth and touched up with same primer or finish touch up paint as applied by the manufacturer, and as specified herein.
 - 2. Remove rust before touch up primer is applied.

3.03 FIELD QUALITY CONTROL

- A. Hold a meeting with other trades to review installation procedures and workmanship with a special emphasis on unusual conditions to ensure correct installation procedures.
- B. Security panel system shall be installed in place under the supervision of a qualified supervisor.

END OF SECTION 111950

**SECTION 111953
DETENTION 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. This Section includes the following:
 - 1. Detention hardware for all doors as listed in the "Door Schedule" and specified under this Section.
 - a. Cylinders, padlocks, interchangeable cores and keys for all work.
 - 2. Locking and operating devices for sliding doors; including control cabinets.
 - 3. Detention cylinders for doors specified in other Sections.
 - a. Related Sections include the following:
 - 4. Division 07 Section "Roof Specialties" for roof hatches with detention door hardware.
 - 5. Division 08 Section "Hollow Metal Doors and Frames" for astragals provided as part of a fire-rated labeled assembly.
 - 6. Division 08 Section "Detention Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
 - 7. Division 08 Section "Access Doors"
 - 8. Division 08 Section "Overhead Coiling Doors" and Section "Coiling Counter Shutters".
 - 9. Division 08 Section "Door Hardware" for non-security door hardware.
 - 10. Division 28 Sections for integrated security access control system, including connections to perimeter security, detention door control, intercommunication's, and closed-circuit television systems for electrified and pneumatic detention door hardware.

1.03 PERFORMANCE REQUIREMENTS

- A. Swinging Detention Door Assemblies: Provide detention door hardware as part of a detention door assembly that complies with security grade indicated, when tested according to ASTM F 1450, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
 - 1. Tool-Attack Resistance: Comply with small-tool-attack-resistance rating when tested according to UL 1034 and UL 437.
- B. Detention Door Hardware Functional Performance: Provide detention door hardware with features, functions, and internal equipment required to perform control and monitoring functions indicated in Division 28 Sections.

1.04 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of detention door hardware.
- B. Shop Drawings: For each type of detention door hardware. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Wiring Diagrams: Detail power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring for electrified and pneumatic detention door hardware. Include the following:
 - a. System schematic.
 - b. Point-to-point wiring diagram, including location of connections.
 - c. Riser diagram.
 - d. Elevation of each detention door.
 - 2. Compressed-Air System Diagrams: Detail compressed-air piping for door control systems and differentiate between manufacturer-installed and field-installed piping for pneumatic detention door hardware. Include the following:

- a. System schematic.
- b. Point-to-point piping diagram.
- c. Riser diagram.
- d. Elevation of each detention door.
3. Detail interface between electrified detention door hardware and detention monitoring and control system.
4. Detail interface between pneumatic detention door hardware and detention monitoring and control system.
- C. Samples: For each type of exposed finish of each type of detention door hardware indicated below, full size. Tag with full description for coordination with the detention door hardware sets. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.
 1. Detention Door Hardware: As follows:
 - a. Detention hinges.
 - b. Detention locks and latches.
 - c. Cylinders and keys.
 - d. Detention operating trim.
 - e. Security door closers.
 - f. Detention floor stops.
 - g. As requested by Architect.
 2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Product Certificates: For each type of pneumatic detention door hardware, signed by product manufacturer.
 1. Certify that detention door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
 2. Qualification Data: For Installer, supplier and/or Architectural Hardware Consultant.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency or performed by a qualified testing agency, for each type of detention lock and latch, security door closer and sliding detention door device.
- F. Maintenance Data: For each type of detention door hardware to include in maintenance manual.
- G. Operation and Maintenance Data: For pneumatic detention door hardware to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 include the following:
 1. Normal remote security operation.
 2. Normal local security operation.
 3. Emergency security operation.
- H. Warranties: Special warranties specified in this Section.
- I. Other Action Submittals:
 1. Door Hardware Schedule: Comply with requirements specified in Division 08 Section "Door Hardware." Coordinate the final Door Hardware Schedule with detention doors, frames, other door hardware, and related work to ensure proper size, thickness, hand, function, and finish of detention door hardware.
 - a. Integrate detention door hardware indicated in Part 3 "Detention Door Hardware Sets" Article into the Door Hardware Schedule, and indicate complete designations of every item required for each door and opening.
 2. Keying Schedule: Comply with requirements specified in Division 08 Section "Door Hardware." Coordinate detention keying with other door hardware in the final keying schedule.
 - a. Indicate each lock and type of key using the following prefixes: "P" for paracentric, "M" for mogul and "C" for commercial.

3. Include the following as minimum requirements in initial submittal package:
 - a. Key Plan:
 - 1) Submit a proposed keying plan.
 - 2) Show all detention doors and equipment to be operated by key and shall contain room identification and numbers associated with each door or piece of equipment.
 - 3) Identify electrically controlled or operated doors with an "E" symbol.
 - 4) Prefix lock types as follows: "P" for paracentric, "M" for mogul and "C" for commercial.
 - 5) Exclude dimensions and other equipment information from this plan.
 - b. Hardware Schedule:
 - 1) Submit hardware on a vertical schedule.
 - 2) Indicate the degree of opening for each door, the Architect's hardware set number, finishes, and substitutions proposed for specified items.
 - 3) List all doors required under this Section in numerical order and show keying proposed for each in accordance with keying plans.
- J. Other Informational Submittals:
 1. Examination reports documenting inspections of substrates, areas, and conditions.
 2. Anchor inspection reports documenting inspections of built-in and cast-in anchors.
 3. Field quality-control reports documenting inspections of installed products.
 4. Field quality-control certification.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer and an authorized representative of detention door hardware manufacturer for installation and maintenance of units required for this Project.
- B. Supplier Qualifications: Detention door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about detention door hardware and keying.
 1. Pneumatic Detention Door Hardware Supplier Qualifications: An experienced detention door hardware supplier who has completed projects with pneumatic detention door hardware 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, and who is acceptable to manufacturer of primary materials.
 - a. Engineering Responsibility: Prepare data for pneumatic detention 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.
 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
- C. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for detention door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
 1. Pneumatic Detention Door Hardware Qualifications: Experienced in providing consulting services for pneumatic detention door hardware installations.
- D. Source Limitations: Obtain each type and variety of detention door hardware through one source from a single manufacturer, unless otherwise indicated.
 1. Provide pneumatic detention door hardware from same manufacturer as mechanical detention door hardware, unless otherwise indicated.
- E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1, FED-STD-795, "Uniform Federal Accessibility Standards," as follows:
 - a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
 - b. Security Door Closers: Comply with the following maximum opening-force requirements indicated:
 - 1) Interior Hinged Doors: 5 lbf (22 N) applied perpendicular to door.
 - 2) Sliding Doors: 5 lbf (22 N) applied parallel to door at latch.
 - 3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 2. NFPA 101: Comply with the following for means of egress doors:
 - a. Latches and Locks: Not more than 15 lbf (67 N) to release the latch.
 - b. Security Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
 - c. Sliding Detention Door Devices: Not more than 50 lbf (222 N) to slide door to its fully open position with a perpendicular force of 50 lbf (222 N) against door.
 3. Pneumatic Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Fire-Rated Detention Door Assemblies: Provide detention door hardware for 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 NFPA 252.
1. Test Pressure: Test at atmospheric pressure
- G. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing detention door hardware keying system including, but not limited to, the following:
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 2. Preliminary key system schematic diagram.
 3. Requirements for key control system.
 4. Address for delivery of keys.
 5. Include Owner and Owners Representative.
 6. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to detention door hardware including, but not limited to, the following:
 7. Inspect and discuss compressed-air and control system roughing-in and other preparatory work performed by other trades.
 8. Review sequence of operation for each type of pneumatic detention door hardware.
 9. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 10. Review required testing, inspecting, and certifying procedures.

1.06 KEYS FOR SECURITY DETENTION LOCKS

- A. The Construction Manager and security and non-security Hardware Contractor shall be responsible for the safekeeping of all keys for locks provided under this Section, as it pertains to his scope of work. He shall exercise care that the security of the building is not breached through job site loss or theft of keys being used for hardware installation or "fit-up" purposes.
- B. Each key for detention locks shall be die-stamped with identification corresponding to that on the approved key schedule.

- C. Upon completion of his job site work, and prior to final acceptance, the Contractor shall present all keys (as shown on Contract Documents) to the Owner's designated custodian and obtain a signed receipt.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Inventory detention door hardware on receipt and provide secure lockup for detention door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver keys to Owner by registered mail or overnight package service.
 - 1. Submit documentation of receipts indicating chain of custody to architect for owners record.

1.08 COORDINATION

- A. Templates: Obtain and distribute, to the parties involved, templates for detention doors, frames, and other work specified to be factory prepared for installing detention door hardware.
- B. Electrical System Roughing-in: Coordinate layout and installation of electrified detention door hardware with connections to power supplies and detention monitoring and control system.
- C. Compressed-Air System Roughing-in: Coordinate layout and installation of pneumatic detention door hardware with connections to compressed-air supplies and detention monitoring and control system.

1.09 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of detention door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of operators and detention door hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering or detention use.
- B. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated.
- C. Warranty Period for Continuous-Pin Detention Hinges: 10 years from date of Substantial Completion, unless otherwise indicated.
- D. Warranty Period for Security Door Closers: 10 years from date of Substantial Completion.

1.10 MAINTENANCE SERVICE

- A. Maintenance and Operating Instructions:
 - 1. The Contractor shall provide the Owner two (2) copies of an operating and maintenance manual covering all locking and operating devices furnished and installed under this Section. These manuals shall clearly identify all parts and include the manufacturer's standard part number for each component of the various locking and operating devices and other mechanisms provided.
 - 2. After the building is substantially complete and prior to application for final payment, the Contractor shall, for a period of time deemed necessary by the Owner, not to exceed one (1) week, instruct designated personnel in the proper operation and maintenance of all equipment furnished and installed under this Section.
 - 3. The Contractor shall furnish two copies of training recording to Owner in digital tape format.
 - 4. The Contractor shall, following the operation and maintenance instruction period, provide the building maintenance department two (2) of each type of special tools required for installing, removing or adjustment of all items of equipment and hardware provided under this Section.

- B. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance
- C. instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of detention door hardware.
- D. Tool Kit: Provide six sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.

1.11 EXTRA MATERIAL

- A. Furnish the Owner with two complete spare sets of all pneumatic door operating mechanisms, including locking mechanisms for swing doors and sliding doors, two (2) each right and left hand gears, switches, etc.
- B. At a minimum, the Construction Manager shall provide the following:
 - 1. Two (2) sets of security tools (bits, drivers and holders) for each type and size security screw on this project.
 - 2. Two (2) Molex pin extractor tools.
 - 3. Two (2) limit switches, each size and type used inside the locks and devices on this project.
 - 4. Two (2) air cylinders of each type and size used on this project.
 - 5. Two (2) electronic solenoid valves of each type and size used on this project.
 - 6. Two (2) door position switches of each type used on this project.
 - 7. Twenty-five (25) nylon tube "quick" connectors of each type and size used on this project.
 - 8. 250 ft. of each type and size of nylon tube used on this project.
 - 9. Five percent (5%) of each size and type security screw used on this project.
 - 10. Five (5) spare blank ASSA keys, per A and B side cut.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Door Locks: Airteq (AT), Division of Cornerstone Detention, Montgomery, AL
 - 2. No substitutions.
- B. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 - 2. Products: Subject to compliance with requirements, provide one of the products specified.
 - 3. Basis-of-Design Product: The design for each detention door hardware is based on the product named or included in detention door hardware sets. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 SCHEDULED DETENTION DOOR HARDWARE

- A. General: Provide detention door hardware for each detention door to comply with requirements in this Section and detention door hardware sets indicated in door and frame schedule, detention door hardware sets indicated in Part 3 "Detention Door Hardware Sets" Article, and the Door Hardware Schedule at the end of Part 3 in Division 08 Section "Door Hardware."
 - 1. Detention Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturer's products.
 - 2. Sequence of Operation: Provide pneumatic detention door hardware function, sequence of operation, and interface with other building systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of detention door hardware are indicated in Part 3 "Detention Door Hardware Sets" Article. Products are identified by using detention door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each detention door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in detention door hardware sets.

2.03 MISCELLANEOUS HARDWARE FOR SECURITY DOORS

- A. Acceptable Manufacturers: Except as otherwise specified herein, the equipment and materials of this section shall be products on one the following manufacturers:
 1. Hinges: Airteq,
 2. Pulls: Airteq,
 3. Door Position Switches: Airteq, Sentrol, Securitron.
 4. Door Closures: LCN, Corbin Russwin, Dorma.
 5. Door Stops: Airteq, Glynn Johnson, Ives.
 6. Thresholds: Reese, National Guard, Pemko.
 7. Weatherstrip: Reese, National Guard, Pemko.
 8. Smoke Seal: Reese, National Guard, Pemko.
 9. Silencers: Glynn Johnson, Ives, Rockwood.
- B. Product Description:
 1. Hinges:
 - a. Full Mortise Detention Hinges (AT 604FMCS): Shall be 4-1/2" x 4-1/2" x 0.188" thick, investment cast 304 stainless steel with hospital tips and integral studs on both sides. Pins shall be hardened stainless or ally steel, concealed and non-removable. Each hinge shall be supplied with eight (8) 1/4 - 20 flat head torx machine screws. Hinges for fire labeled doors shall be US 32D finished.
 - b. Surface Mounted Access Door Hinges (AT #603 FS): Shall be 3" x 4" c 0.210" min., fabricated from bonderized steel and prime painted. Hinge barrels shall be solid with no visible pin line. Pin shall be fully welded. Each hinge shall be provided with four (4) 3/8" -16 button head pinned torx machine screws.
 - c. Surface Mounted Food Pass Hinges (AT #603 FP): Shall be 3" x 4" x 0.210" minimum, fabricated from bonderized steel and prime painted. Hinge barrels shall be solid with no visible pin line. Pin shall be fully welded. Hinges shall be provided with a stop capable of restricting the hinge from rotating more than 90 degrees, allowing the food pass door to act as a shelf. Each hinge provided with four 1/8- 16 button head pinned torx machine screws.
 2. Pulls:
 - a. Grip Type door Pulls (AT #612): Shall be cast of brass or bronze with satin finish of approximately US 4 unless specified otherwise in hardware schedule. Overall length, 8-3/4"; hand hold, 5-1/4"; grip clearance, 1- 1/2"; attachment holes, 7-3/4" O.C. Provide two (2) 3/8- 16 x 5/8" oval head torx screws. Provide clear lacquer finished baked for 15 minutes at 350 degrees and allow to cool before packaging.
 - b. Knob Type Door Pulls (AT #613): Shall be cast or machined from brass or bronze with satin finish of approximately US 4 unless specified otherwise in hardware schedule. Diameter, 3-1/4"; projection, 2-3/16". Provide three (3) 10-24 x 1/2" flat head torx screws. Provide clear lacquer finish, baked for 15 minutes at 350 degrees and allow to cool before packaging.
 - c. Flush Type Door Pulls (AT #614) Shall be cast of brass or bronze with satin finish of approximately US 4 unless specified otherwise in hardware schedule. Size, 4" x 5" x 1/8" pocket grip 1" deep. Provide four (4) 1/4 - 20 x 3/8" flat head torx screws. Provide clear lacquer finish, baked for 15 minutes at 350 degrees and allow to cool before packaging.

- d. Recessed Magnetic Door Position Switches (AT #6200): Shall be a five (5) reed switch, magnet mortised type assembly used for remotely monitoring the door status/position. The device shall be moisture resistant and fit within 2" hollow metal door jamb. The device shall be field adjustable on 2 axis and supplied with a 3 ft. vinyl jacketed lead wire and a 3 pin Molex connector. The device shall be all steel construction. The switch and magnet shall be encased in epoxy resin. The overall dimension shall be 1-1/4" x 4-7/8" x 1".
- e. High Security Closer with Door Position Switches (LCN #2210 Series): Shall be controlled by overhead concealed closers which have been tested to ten million (10,000,000) opening-closing cycles. Closers shall have full hydraulic rack and pinion action with high strength cast iron cylinder. Spring power shall be adjustable. Hydraulic fluid shall be of a type requiring non seasonal adjustment for temperature ranging from 120 degrees F to -30 degrees F. Separate tamperproof screw valves shall provide independent regularization of latch speed, general speed, and hydraulic back check. Regulating screws shall be accessible through a heavy duty mounting plate when finish plates are removed. Closers shall have an integral electro-mechanical device rated not less than 24 VAC @ 10 amperes to detect and signal rotation of the closer pinion. This device shall be field adjustable to allow setting for each door and fitting with a protective shield. Installation of the finish plate shall fully conceal all adjustment mechanisms. Closer shall have an extra heavy duty forged steel concealed arm. The low friction track roller shall be attached to the arm by a threaded mounting. Closers shall have a metal track designed to prevent jamming and to eject foreign objects placed in the track mortised into the top of the door. The exposed fasteners shall be torx drive with a security pin.
- f. Wall or Floor Mounted Door Stops (PDI #DS-1): Shall be a tamper resistant device that is embedded into the wall or floor with an epoxy resin adhesive. Bumper shall be 2" diameter x 3- 1/2" long and made from a non-hazardous silicone elastomer, 80 durometer. The threaded and grooved steel mounting shank shall be 5/8" diameter and embedded into the bumper at least half the length of the bumper. Mounting shank shall extend 2-1/2" beyond the bumper bottom for embedding into the wall or floor.
- g. Thresholds:
 - 1) Thresholds (Pemko #2005AV): Shall be supplied at all exterior door openings and installed with flat head torx screws.
 - 2) Pass-Resistant Thresholds.
- h. Weatherstrip (Pemko #S88): Shall be a self-adhesive and pressure sensitive door gasketing material that may be compressed sufficiently to seal 1/6" toleranced door and will not loose its form. The product shall be non-toxic, self-extinguishing and impervious to fungus and mildew. Once installed razor cut to approximately in 12" increments.
- i. Door Silencers (Glynn-Johnson #64): Shall be standard resilient type and removable for replacement.

2.04 MECHANICAL LOCKS AND SLIDING DEVICES FOR SECURITY DOORS

- A. Acceptable Manufacturers: Except as otherwise specified herein, the equipment and materials of this section shall be products on one the following manufacturers:
 - 1. Airteq (AT), Division of Cornerstone Detention, Montgomery, AL
 - 2. No substitutions.
- B. Mechanical Locks and Accessories for Swinging Doors:
 - 1. Standard Features:
 - a. Lock case to be high tensile strength alloy steel with cold rolled cover.
 - b. All lock steel parts shall be zinc plated for corrosion protection and are suitable for both interior and exterior applications.
 - c. Keyed One Side (K1) or Keyed Two Sides (K2).
 - 2. Mechanical Deadbolt, AT #5080:

- a. Lock size to be approximately 5-1/2" x 3-3/4" x 1-1/2". Deadbolt to be 3/4" x 2" with 3/4" throw. Deadbolt locking and unlocking activated by key only.
 - b. Deadbolt to be made of cold rolled steel with 1/4" diameter hardened steel inserts (2 each) unless otherwise specified.
3. Accessories:
- a. Mortise keeper.
 - b. Mortise keeper with dust box.
 - c. Surface mounted keeper.
 - d. Food pass keeper AT #5017 M.
 - e. Mortise strike keeper switch, SFDEC #262 FP, SPDT, 5 amp at 125 VAC, 0.5 amp as 125 VDC, UL recognized.
 - f. Mortise strike keeper.
 - g. Surface mounted strike keeper.
 - h. Escutcheon (AT #601).
 - i. Cylinder Shield (AT #602CS).

2.05 COMPRESSED AIR SYSTEM, PNEUMATIC LOCKS AND LOCKING DEVICES

- A. Acceptable Manufacturers: Except as otherwise specified herein, the equipment and materials of this section shall be components fabricated by one single manufacturer. The following manufacturers are pre-qualified to supply the products specified under this Section:
1. Airteq (AT), Division of Cornerstone Detention, Montgomery, AL.
 2. No substitutions
- B. This section includes complete system of pneumatic locking and operating devices, under electronic control, for individual swing and sliding detention doors as scheduled.
1. System Components:
 - a. Air lines and associated fittings.
 - b. Pneumatic swing door locks.
- C. Compressed Air Distribution System:
1. Air piping shall be sized to permit normal operation of locking devices, including group release, without dropping below 60 PSIG line pressure for more than five (5) seconds. Air pressure to any individual component, beyond compressor/dryer/filtration system, shall not exceed 125 PSIG at 70 degrees F.
 2. Air Distribution piping shall be Nylon tubing rated for 100 PSIG at 200 degrees F.
 3. Nylon tubing shall be run in conduit, raceways or cable trays. Splices or tees shall be permitted only in accessible locations such as junction boxes or pipe chases.
 4. All conduit is to be run concealed in occupied spaces. Conceal conduit in all other spaces wherever possible. Where exposed, piping/tubing conduit is to be securely fastened at regular intervals and run in a neat workmanlike manner.
 5. Tubing shall be tagged at all manifolds and boxes. Valves shall be tagged to correspond with the valve numbers indicated on the approved shop drawings and the normal operating position shall be indicated.
 6. All distribution manifolds shall be aluminum, brass or stainless steel.
 7. All air lines shall be purged before final connections are made to the end-of-line devices.
- D. Pneumatic operated security locks for individual swinging doors, complete with integral electronic and pneumatic components.
1. Function:
 - a. Normal Operation:
 - 1) When electrical power is applied to the solenoid valve, the latchbolt shall retract. The bolt shall remain retracted as long as power is applied.
 - 2) When power is removed, the latchbolt shall extend, locking the door if closed, and allowing the door to be slam-locked if open.
 - b. Manual Operation:

- 1) Each lock shall have a local manual key override lock / unlock feature. Keyed two sides (K2), keyed one side (K1).
- 2) Rotating the key shall mechanically retract the latchbolt. Removing the key shall extend the bolt, locking the door if closed, and allowing the door to be slam-locked if open.
2. Components:
 - a. Mechanical:
 - 1) Lock shall operate when supplied with air between 40 PSIG minimum and 124 PSIG maximum.
 - 2) Lock shall operate as a fail-secure slam-lock. Unlocks when energized.
 - 3) Lock body shall be made of steel.
 - 4) Lock shall be factory plumed with a quick connect air fitting.
 - 5) Lock shall be supplied with a security ring to protect the key cylinder. The security ring shall be supplied unpainted, for installation in the hollow metal frame by the hollow metal manufacturer.
 - 6) Cylinder extensions shall be provided for locks keyed 2 sides or keyed stop side.
 - b. Electrical:
 - 1) Solenoid valve shall be 1.5 watt, 115VAC/24 VDC, continuous rated by valve manufacturer.
 - 2) Lock shall be provided with a lock status switch to provide interlocking capabilities.
 - 3) Switches shall be of the snap acting mechanical type, UL recognized and rated at 5 amps.
 - 4) Lock shall be factory wired to a plug disconnect.
 - 5) Lock status switch shall provide for deadlock indication.
3. Special Features: All Sally Port exit doors, cell doors, dayroom doors entering corridors, etc. the following features shall be provided:
 - a. Remote Latch Holdback Feature (RLHB): Emergency release application only. Latchbolt is retracted by the push of a button at the control panel and remains electrically retracted until the button is pushed a second time. Latchbolt extends when power is removed, regardless of the door position. NOTE: This is an electronic control function and must be coordinated with the locking control system.
 - b. Key Operated Latch Holdback Feature (KLHB): latchbolt in retracted locally by key and remains mechanically retracted until relocked with the key.
 - c. Emergency Latch Holdback Feature (ELHB): Latchbolt is retracted by remote electronic control and remains mechanically retracted until relocked locally by key.
 - d. Key Switch (KS): Door is electrically unlocked by key operated switch at the lock.
 - e. UL10B: Underwriters' laboratories, Inc. approved electronically controlled single point lock for use on swing fire rated doors having a rating up to and including 3 hours.
 - f. ASTM Grade 1 Rating (GR1): Meets ASTM F1577, Grade 1, Impact Standards. (Note - Special mounting and strike keeper to meet this feature consult the manufacturer.)
4. A maximum security remote controlled pneumatic operates lock for individual swing doors that complies with the standard test methods defined in ASTM F1577-95b, security Grade 1. An 8" frame mounted slam-lock with automatic dead locking. Airteq Series 9700/9900.
 - a. Physical Characteristics:
 - 1) The lock shall automatically deadlock when the door is slam-locked in the manual mode even in the event of a total loss of air and/or electric power.
 - 2) Latchbolt shall be 2" x 3/4" alloy steel, case hardened Rockwell C 60 to a depth of 0.030" and shall have a 1" throw and 60,000-pound shear strength.
 - 3) Lock shall have a mechanical roller-bolt deadlock actuator and shall automatically deadlock when door is closed.
 - 4) Lock shall be supplied with Mogul key cylinder(s) as scheduled.

- b. Special Features: Where specified by the security hardware/door schedule, the following features shall be provided. NOTE: All Sally Port exit doors shall receive remote latch holdback (RLHB), in the emergency release application only.
 - 1) Remote door unlock, latch bolt to retract and automatically relock in a timely manner without moving the door.
 - 2) Underwriters Laboratories, Inc. (UL): UL approved electrically controlled single point lock for use on swinging fire doors having a rating up to and including 3 hours. (Consult manufacturer when a UL label is required.)
 - 3) Knob Release (KR): Latch bolt is retracted by knob on one side of lock. Knob is always active.
 - 4) Lock is available with high security mogul type key cylinder.
 - 5) ASTM Grade 1 Rating (GR1): Meets ASTM F1577, Grade 1, impact standards. NOTE: Special mounting strike keeper required to meet this feature, consult the manufacturer.
5. Emergency Release System: Where specified by the Hardware Schedule, security hardware schedule or door schedule, the following emergency release functions shall be provided for sliding cell door locking devices (One for each housing module):
 - a. Remote manual Emergency Release System (RMERS):
 - 1) Provide compressed air emergency release tank(s) and valve assembly to emergency unlock cell doors, in defined
 - 2) groups, in the event of total loss of air and/or electric power.
 - 3) The emergency release tank(s) and valve assembly shall be installed in a lockable cabinet, where directed by the Architect. The cabinet shall be clearly labeled "Emergency Release System".
 - 4) The emergency release system shall be totally manual in operation. Once the system has been activated, the doors shall unlock and remain unlocked until the system is deactivated. Once unlocked, doors may then be manually moved to the open position.
 - 5) Check valves shall be installed on the supply lines at each tank to prevent air from leaking out of the tank when not being supplied from the air compressor(s).
 - 6) Air lines serving each group of devices from the emergency release system, shall be run in the same raceway/conduit as the normal air lines.
 - 7) Air tubing for the emergency release system shall be a minimum of 1/4" outside diameter, and shall be properly labeled ("Emergency") at each device, splice or tee.
 - 8) Color coded air tubing may be used in place of labeled tubing.

2.06 KEYING AND KEYS

A. Keying and Keys:

1. The DEC will prepare a proposed "Key Schedule" showing their recommendation for the system layout. The DEC will provide copies of the system layout sorted by both door and number and key change. The Architect and Owner will review the schedule and make desired modifications. If require, the DEC, Architect and Owner shall meet to finalize the system layout.
2. Commercial Best High Security mortise type cylinders shall be keyed in sets and master keyed, grandmaster keyed, etc. to level as directed. Provide three keys per key change and three keys per master level.
3. Mogul prison lock type shall be keyed in sets and master keyed, grandmaster keyed, etc. to level as directed. Provide three keys per key change and three keys per master level.

B. Key Control System:

1. Location = Room "OFF. STA. - 1.304"
 - a. Basis-of-Design Products: The design for the cabinets and components is based on Telkee, Inc. Subject to compliance with requirements; provide the named product or a comparable product.

- b. Each cabinet shall have a maximum-security push-button lock manufactured by Simplex, or equal. System shall include complete set-up instructions, with three way cross index system and dual tag system, and instructions to the Owner on proper use of the system. DEC shall provide one cabinet and shall incorporate the keys for finish hardware specified elsewhere.
- c. Capacity: Sized to have one hook for each key code plus 20% future expansion.

2.07 FINISHES

- A. Standard: Comply with BHMA A156.18.
- 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.
- D. BHMA Designations: Comply with base material and finish requirements indicated by the following:
 - 1. BHMA 600: Primed for painting, over steel base metal.
 - 2. BHMA 606: Satin brass, clear coated, over brass base metal.
 - 3. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.
 - 4. BHMA 652: Satin chromium plated over nickel, over steel base metal.

2.08 DETENTION DOOR HARDWARE SCHEDULE

- A. Detention Door Hardware Schedule

HARDWARE SET DH-1			
HOLDING CELL DOORS (SWING) - CONTROLLED	(1)	LOCK	Airteq 9500 - RLB - Keyed one side - Mogul
	(1)	STRIKE	BY LOCK MFR.
	*	HINGES	Airteq 604 FMCS
	*	HINGES, ALTERNATE BID	HT FBB191 4-1/2 x 4-1/2 NRP US26D
	(1)	LOOP PULL (CELL EXTERIOR SIDE)	Airteq 612
	(1)	FLUSH PULL (INTERIOR SIDE)	BY DOOR MFR.
	(1)	FOOD / CUFF PORT	SLIDING - BY DOOR MFR.
	(1)	CONCEALED DOOR POSITION SWITCH	Airteq 6200
	(1)	STOP	AS SPECIFIED ELSEWHERE IN THIS SECTION
	(1)	SMOKE SEALS (**)	NGP
	NOTE: (*) INDICATES QUANTITY IS SPECIFIED ELSEWHERE IN THIS SECTION		
NOTE: (**) PROVIDE SMOKE SEALS AT FIRE AND SMOKE RATED OPENINGS ONLY			
HARDWARE SET DH-2			
HOLDING CELL DOORS (SWING) - KEYED ONLY	(1)	LOCK	Airteq 9500 - Keyed only - Keyed one side - Mogul
	(1)	STRIKE	BY LOCK MFR.
	*	HINGES	Airteq 604 FMCS

	*	HINGES, ALTERNATE BID	HT FBB191 4-1/2 X 4-1/2 NRP US26D
	(1)	LOOP PULL (CELL EXTERIOR SIDE)	Airteq 612
	(1)	FLUSH PULL (INTERIOR SIDE)	BY DOOR MFR.
	(1)	FOOD / CUFF PORT	SLIDING - BY DOOR MFR.
	(1)	CONCEALED DOOR POSITION SWITCH	Airteq 6200
	(1)	STOP	AS SPECIFIED ELSEWHERE IN THIS SECTION
	(1)	SMOKE SEALS (**)	NGP
	NOTE: (*) INDICATES QUANTITY IS SPECIFIED ELSEWHERE IN THIS SECTION		
	NOTE: (**) PROVIDE SMOKE SEALS AT FIRE AND SMOKE RATED OPENINGS ONLY		
HARDWARE SET DH-3			
CHASE DOORS	(1)	LOCK	SCHLAGE L9040 - STOREROOM FUNCTION
	(1)	STRIKE	BY LOCK MFR.
	*	HINGES	Airteq 604 FMCS
	*	HINGES, ALTERNATE BID	HT FBB191 4-1/2 X 4-1/2 NRP US26D
	(1)	STOP	AS SPECIFIED ELSEWHERE IN THIS SECTION
HARDWARE SET DH-4			
SECURE CORRIDOR DOORS (SWING)	(1)	LOCK	Airteq 9500 - RLB - Keyed one side - Mogul
	(1)	STRIKE	BY LOCK MFR.
	*	HINGES	Airteq 604 FMCS
	*	HINGES, ALTERNATE BID	HT FBB191 4-1/2 X 4-1/2 NRP US26D
	(2)	LOOP PULL (1 EACH SIDE)	Airteq 612
	(1)	CLOSER	LCN 2210 SERIES - AVB
	(1)	CONCEALED DOOR POSITION SWITCH	Airteq 6200
	(1)	SMOKE SEALS	NGP
	(1)	STOP	AS SPECIFIED ELSEWHERE IN THIS SECTION
	NOTE: (*) INDICATES QUANTITY IS SPECIFIED ELSEWHERE IN THIS SECTION		
HARDWARE SET DH-4a			
SECURE CORRIDOR DOORS - EXTERIOR (SWING)	(1)	LOCK	AIRTEQ 9500 - RLB - KEYED ON ONE SIDE - MOGUL
	(1)	STRIKE	BY LOCK MFR.
	*	HINGES	AIRTEQ 604 FMCS
	*	HINGES, ALTERNATE BID	HT FBB191 4-1/2 X 4-1/2 NRP US26D
	(2)	LOOP PULL (1 EACH SIDE)	AIRTEQ 612
	(1)	CLOSER	LCN 2210 SERIES - AVB
	(1)	CONCEALED DOOR POSI	AIRTEQ 6200

		TION SWITCH	
	(1)	WEATHER STRIPPING	NGP
	(1)	STOP	AS SPECIFIED ELSEWHERE IN THIS SECTION
	(1)	THRESHOLD	NGP-8533
	NOTE: (*) INDICATES QUANTITY IS SPECIFIED ELSEWHERE IN THIS SECTION		
HARDWARE SET DH-5			
INTERVIEW ROOM DOORS (SWING)	(1)	LOCK	Airteq 90407
	(1)	STRIKE	BY LOCK MFR.
	*	HINGES	Airteq 604 FMCS
	*	HINGES, ALTERNATE BID	HT FBB191 4-1/2 X 4-1/2 NRP US26D
	(1)	STOP	AS SPECIFIED ELSEWHERE IN THIS SECTION
	NOTE: (*) INDICATES QUANTITY IS SPECIFIED ELSEWHERE IN THIS SECTION		
HARDWARE SET DH-6			
CORRIDOR TO COURTROOM DOORS (SWING)	(1)	LOCK	SCHLAGE L9040 - storeroom function
	(1)	STRIKE	HES 1500 SERIES - electric strike
	*	HINGES	Airteq 604 FMCS
	*	HINGES, ALTERNATE BID	HT FBB191 4-1/2 X 4-1/2 NRP US26D
	(1)	CONCEALED DOOR POSITION SWITCH	Airteq 6200
	(1)	SMOKE SEALS	NGP
	(1)	STOP	AS SPECIFIED ELSEWHERE IN THIS SECTION
	NOTE: (*) INDICATES QUANTITY IS SPECIFIED ELSEWHERE IN THIS SECTION		

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine detention doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of detention door hardware.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of detention door hardware connections before detention door hardware installation.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of detention door hardware.
- B. Inspect built-in and cast-in anchor installations before installing detention door hardware to verify that anchor installations comply with requirements. Prepare inspection reports.
 - 1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
 - 2. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- C. Verify locations of detention door hardware with those indicated on Coordination Drawings.
- D. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified detention door hardware installation.

- E. Examine roughing-in for compressed-air systems to verify actual locations of piping connections before pneumatic detention door hardware installation.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Steel Detention Doors and Frames: Comply with DHI A115 Series.
 - 1. Surface-Applied Detention Door Hardware: Drill and tap detention doors and frames according to SDI 107.

3.03 INSTALLATION

- A. Mounting Heights: Mount detention door hardware units at heights indicated in the following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Steel Detention Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
- B. Install each detention door hardware item to comply with Coordination Drawings and manufacturer's written instructions. Where cutting and fitting are required to install detention door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. 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.
- C. Install interconnecting wiring and connectors between detention door hardware devices. Terminate device wiring for detention door hardware installed in swinging doors at a plug-type connector located in lock pocket or door frame junction box and for sliding doors at a junction box in door frame.
- D. Security Fasteners: Install detention door hardware using security fasteners with head style appropriate for installation requirements, strength, and finish of adjacent materials, except that a maximum of two different sets of tools shall be required to operate security fasteners for Project.
- E. Paint factory prime-painted detention door hardware to match construction in which it is installed. Comply with requirements in Division 09 painting Sections.

3.04 FIELD QUALITY CONTROL

- A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing electrified and pneumatic detention door hardware and after electrical circuitry has been energized and compressed-air system is functional, test detention door hardware for compliance with requirements.
 - a. Test: Operate lock of each door and group of doors in normal remote, normal local, and emergency operating modes. Verify that remote controls operate correct door locks and in correct sequence.
 - 2. Verify that lock bolts engage strikes with required bolt projection.
 - 3. Verify that detention door hardware is installed, connected, and adjusted according to the Contract Documents.
 - 4. Verify that electrical wiring installation complies with manufacturer's submittal and written installation requirements.

- C. Remove and replace detention work where inspections indicate that work does not comply with specified requirements. Remove malfunctioning units, replace with new units, and retest as specified above.
- D. Perform additional inspections to determine compliance of replaced or additional work. Prepare inspection reports.
- E. Prepare field quality-control certification that states installed products and their installation comply with requirements in the Contract Documents.

3.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of detention door hardware and each detention door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust detention door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 2. Security Door Closers: Adjust sweep period so that, from an open position of 70 degrees, detention door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to leading edge of detention door.
- B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
 - 1. Examine and readjust each item of detention door hardware as necessary to ensure function of detention doors and detention door hardware.
 - 2. Instruct Owner's personnel on recommended maintenance procedures.
 - 3. Replace detention door hardware items that have deteriorated or failed due to faulty design, materials, or installation of detention door hardware units.

3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by detention 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 detention door hardware is without damage or deterioration at time of Substantial Completion.

3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain detention door hardware and detention door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.08 SECURITY/COMMERCIAL HARDWARE SCHEDULE

- A. It is the intent, to have all door hardware, both security and non-security builders hardware, furnished and installed as part of the Detention Equipment Contract as follows:
- B. NOTE: Hardware supplier to develop all door functions (security and non-security) for all door hardware during the Shop Drawing submittal phase, per manufacturer's requirements.

END OF SECTION 111953

**SECTION 111963
DETENTION FURNISHINGS AND EQUIPMENT**

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. This Section includes, but not limited to the following:
 - 1. Detention Mirror
 - 2. ADA Detention Mirror
 - 3. Detention Toilet Tissue Holder
 - 4. Detention Floor Mounted Stool
 - 5. Detention Grab Bars
 - 6. Floor Mounted Bench Seat
 - 7. Detention Access Panel (DAP)
 - 8. Fire Rate Detention Access Panel (DAPF)
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications"
 - 2. Division 09 Sections "Interior Painting" and "Exterior Painting"
 - 3. Division 11 Section "General Provisions for Detention Work"
 - 4. Division 07 Section "Security Joint Sealants"
 - 5. Division 11 Section "Detention Hardware"
 - 6. Division 11 Section "Tamper Proof Metal Fasteners"

1.03 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of detention furnishing indicated.
- B. Shop Drawings: For each type of detention furnishing. Include plans, elevations, sections, details, and attachments to other Work.
- C. Coordination Drawings: Drawings of each built-in anchor supporting detention furnishings, including those to be installed as work of other Sections, drawn to scale and coordinating anchorage with detention furnishings. Show the following:
 - 1. Locations, dimensions, and profiles of wall and floor reinforcements.
 - 2. Locations and installation details of built-in anchors.
 - 3. Elevations of each detention furnishing showing dimensions of furnishing, preparations for receiving anchors, and locations of anchorage.
 - 4. Details of attachment of each detention furnishing to built-in anchors.
- D. Samples: For each type of detention furnishing with factory-applied color finishes.

1.04 QUALITY ASSURANCE

- A. Provide detention furnishings and equipment manufactured by a single firm specializing in the production of this type of work.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle detention furnishings and equipment per manufacturer's requirements.

PART 2 PRODUCTS

2.01 MANUFACTURER OF DETENTION FURNISHINGS AND EQUIPMENT

- A. Acceptable Manufacturers:
 - 1. As listed for individual items herein.

- B. Others seeking approval as a Detention Equipment/Furnishing Supplier are to make substitution requests in accordance with the requirements of the Contract, and which include the following:
1. Submit evidence that firm has a minimum of ten (10) years' experience in successfully completing projects of equal scope and magnitude with products as specified herein. Such evidence shall consist of a list of not less than five (5) projects which have been in actual and satisfactory use for not less than five (5) years. Provide a list of contacts at each facility, addresses and phone numbers
 2. Provide a list of all projects in the past five (5) years in which the proposed firm has been involved in litigation with a city, county, state or federal government agency and the status thereof.
 3. Submit copies of welder's certification for all personnel who will perform services on this project.
 4. Submit a statement letter from the Surety Company stating that a 100% Payment and Performance Bond will be supplied if selected as the successful Detention Equipment provider Supplier

2.02 DETENTION FURNITURE – MISSING NUMBERS INDICATE NO ITEM.

- A. (DE1) Detention Mirror
1. 12 inches wide by 16 inches high.
 2. Provide minimum above each inmate sink and 2 above each ADA inmate sink and other locations as indicated.
 3. Frame fabricated from type 304 (18-8), 0.067 inches stainless steel, seamless construction, No. 3 finish.
 4. Reflecting surface fabricated from 20 GA, type 304 (18-8) stainless steel, polished to No. 8 architectural finish.
 5. Wall mounted with six each $\frac{1}{4}$ -20 anchors (length determined by wall thickness)
 6. Acceptable manufacturers:
 - a. Norix
 - b. Viking
 - c. Approved equal
- B. (DE1a) ADA Detention Mirror
1. 12 inches wide by 24 inches high.
 2. Provide minimum above each inmate sink and 2 above each ADA inmate sink and other locations as indicated.
 3. Frame fabricated from type 304 (18-8), 0.067 inches stainless steel, seamless construction, No. 3 finish.
 4. Reflecting surface fabricated from 20 GA, type 304 (18-8) stainless steel, polished to No. 8 architectural finish.
 5. Wall mounted with six each $\frac{1}{4}$ -20 anchors (length determined by wall thickness)
 6. Acceptable manufacturers:
 - a. Norix
 - b. Viking
 - c. Approved equal
- C. (DE2) Chase Mounted Detention Toilet Tissue Holder
1. By Hollow Metal Barrier Wall manufacturer
 2. Acceptable Manufacturers:
 - a. Norix
 - b. Viking
 - c. Approved equal
- D. (DE3) Floor Mounted Detention Stool
1. Seat Material: Rotationally molded plastic
 2. Basis of Design: Cortech Endurance Floor Mounted Stool.

3. Additional manufacturers:
 - a. Norix
 - b. Approved equal
- E. (DE4) 24 inch ADA Type Grab Bar
 1. 1-1/2 inch O.D. Stainless Steel tube
 2. 3 inch O.D Stainless Steel flange
 3. Anchor to walls per manufacturer's recommendation
 4. Acceptable Manufacturers:
 - a. Acorn
 - b. Bradley
 - c. Norix
- F. (DE5a) 36 inch ADA Type Grab Bar
 1. 1-1/2 inch O.D. Stainless Steel tube
 2. 3 inch O.D Stainless Steel flange
 3. Anchor to walls per manufacturer's recommendation
 4. Acceptable Manufacturers:
 - a. Acorn
 - b. Bradley
 - c. Norix
- G. (DE5b) 42 inch ADA Type Grab Bar
 1. 1-1/2 inch O.D. Stainless Steel tube
 2. 3 inch O.D Stainless Steel flange
 3. Anchor to walls per manufacturer's recommendation
 4. Acceptable Manufacturers:
 - a. Acorn
 - b. Bradley
 - c. Norix
- H. (DE5c) L-Shaped ADA Type Grab Bar
 1. Refer to drawings for dimensions
 2. 1-1/2 inch O.D. Stainless Steel tube
 3. 3 inch O.D Stainless Steel flange
 4. Anchor to walls per manufacturer's recommendation
 5. Acceptable Manufacturers:
 - a. Acorn
 - b. Bradley
 - c. Norix
- I. (DAP) Detention Access Panel.
 1. Frame: 3 inches by 2 inches x 3/16 inches steel angles with 1 inch by 1 by 1/8 inch angle stops on 3 sides
 2. Door: 3/16 inch plate steel door with 1-1/24 inch flange on all four sides. Refer to drawings for opening size
 3. Hinges: Equip the panel with two (2) Southern Steel model 203FS (or equal) hinges
 4. Prep for detention lock. Equip with one (1) Southern Steel model 1010-1 (or equal) deadlock
 5. Provide safety chain on swing down ceiling access panels
 6. Provide mounting holes in frames to attach frames to metal framing in drywall construction and to attach masonry anchors in masonry construction
 7. See floor plans for wall mounted DAP locations. See Reflected Ceiling Plans for ceiling mounted DAP locations. Provide and install an additional five (5) wall mounted and five (5) ceiling mounted DAP's in addition to those indicated on the drawings. Coordinate locations with General Contractor
 8. Acceptable Manufacturers:

- a. Argyle Precision
 - b. Viking
 - c. Or approved equal
- J. (DAPF) Fire Rated Detention Access Panel.
1. Fire Resistance Rating: One and one-half hour
 2. Temperature Rise Rating: 250 degree F (139 degree C) at the end of 30 minutes
 3. Frame: 16 gauge cold-rolled steel with 1 inch wide surface mounted trim
 4. Door: 14 gauge cold-rolled steel with 2 inches of fire retardant insulation enclosed in sheet metal
 5. Hinges: Continuous piano hinge
 6. Prep for detention lock. Equip with one (1) Southern Steel model 1017M-1 (or equal) snaplatch
 7. Door Closer: Automatic, self-latching with interior release mechanism
 8. Provide and install an additional five (5) fire rated DAP's to those indicated on the drawings. Coordinate locations with General Contractor
 9. Acceptable Manufacturers:
 - a. Nystrom
 - b. Or approved equal
- K. Detention Equipment Accessories
1. Provide accessories, anchorage inserts and security fasteners for a complete, tamperproof installation.
 2. Exposed Security Fasteners:
 - a. Provide torx-head (star design with center pin) security fasteners for anchoring work in exposed detention areas. Comply with specification section 11 19 93.
 - b. Finish shall match that specified of the item anchored.

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 installation.
- C. Notify the General Contractor in writing of conditions detrimental to the proper and timely completion of the work.
- D. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Expenses carried by the Architect/Engineer, Project Manager or Owner in troubleshooting equipment problems caused by inadequate workmanship or other form of poor performance on the part of the Contractor, shall be borne by the Contractor.
- B. Comply with manufacturer's printed installation instructions.
- C. Touch-up painting of factory finished or factory primed items is the Installer's responsibility.
- D. Fill voids between materials of the detention equipment and embeds or other physical construction with low-mod gel, equal to Sikadur 23, by Sika.

3.03 CLEANING

- A. Clean equipment thoroughly prior to Substantial Completion.

3.04 PROTECTION

- A. Protect equipment and finishes until Substantial Completion.
- B. Replace damaged equipment as directed by the Architect.

END OF SECTION 111963

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**SECTION 111993
TAMPER-RESISTANT FASTENERS**

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. Tamper-resistant metal fasteners.
 - 2. Tamper resistant anchors
 - 3. Accessories.
- B. Related Sections include the following:
 - 1. Division 5 for Metals
 - 2. Division 8 for Openings
 - 3. Division 10 for Specialties
 - 4. Division 11 for Equipment / Detention Equipment
 - 5. Division 22 for Plumbing
 - 6. Division 23 for Heating, Ventilating, and Air-Conditioning (HVAC)
 - 7. Division 26 for Electrical
 - 8. Division 27 for Communications
 - 9. Division 28 for Electronic Safety and Security

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. (no more than 12 different types are allowed)
- B. Submit Data on tools/wrenches to be used for this project.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle per manufacturer's requirements, and per requirements herein.

PART 2 PRODUCTS

2.01 TAMPER-RESISTANT METAL FASTENERS

- A. Exposed Security Fasteners:
 - 1. Center Pin Torx head security fasteners.
 - 2. Finish shall match that specified of the item anchored.
 - 3. Diameter: #4 through ¾".
- B. Expansion Anchors
 - 1. Structural Concrete or masonry stud anchors similar to Hilti Qwik-Bolt or equal.
 - 2. Provide with cap nuts tack welded in place.
 - 3. No threads shall remain exposed.
- C. Fabrication:
 - 1. Fabricate removable tamper-resistant fasteners to allow removal only by tools specifically for individual tamper-resistant fastener design.
 - 2. Plating: Cadmium, zinc, nickel, phosphate and chrome to match adjacent materials.
 - 3. Limit size and shape variations such that no more than six (6) different tools are required for each type of tamper-resistant fastener used on project.

2.02 ACCESSORIES

- A. Screw-thread Adhesive Sealant: Loctite – Blue - #242 or acceptable substitute.

2.03 SOURCES

- A. Security screws may be obtained through the following dealers:
 - 1. Bryce Fastener Company, Inc.; Gilbert, AZ

2. Camcar Division of Textron, Inc.; Rockford, IL
3. Holo-Krome Company; West Hartford, CT
4. Riteloc Company; Freeport, NY
5. Safety Socket Screw Corporation; Chicago, IL
6. Sentry Security Fasteners, Inc.; Peoria, IL
7. Tamper-Pruf Screws, Inc.; Paramount, CA
8. Tanner Bolt & Nut Corporation; Brooklyn, NY

PART 3 EXECUTION

3.01 LOCATIONS

- A. Provide tamper-resistant metal fasteners to work including, but not limited to the General, Mechanical, and Electrical, Detention and Security Electronics Contracts. This shall include fasteners for equipment, furnishings, fixtures, doors, windows, exposed structural connections, attachments and hardware.
- B. Tamper-resistant metal fasteners shall be used for fastenings, except in the following areas:
 1. Mechanical, electrical generator or communications equipment rooms, including roof mounted equipment.
 2. Areas above suspended ceilings, behind access panels and within pipe and duct chases.
 3. All areas not within the secure perimeter. Refer to drawings for definition of areas within the secure perimeter.
- C. Purchase orders for screws for the work of this contract to either manufacturer shall indicate the following:
 1. Fasteners are for Theron W. Ward Judicial Building in Twin Falls, Idaho.

3.02 INSTALLATION

- A. Install work using proper sized tamper-resistant fastener, matched to configuration, structural loading, and size.
- B. Install fasteners with the proper amount of torque as recommended by the manufacturer.
- C. Set tamper-resistant fasteners with screw thread adhesive sealant in accordance with manufacturer's instructions.
- D. Store and maintain inventory control for each installing tool used for installation of security fasteners. After use, installers shall return tools for inventory control. At completion of the project, installing tools shall be turned over to the facility.

3.03 SPARE PARTS

- A. Provide two (2) security fastener kits to the Owner. Kits shall contain all fasteners found on project and a tool with bits. Package each set in an individual kit and deliver to an authorized representative of the owner.

END OF SECTION 111993

**SECTION 113013
RESIDENTIAL APPLIANCES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Kitchen appliances, Owner-Furnished, Contractor-Installed.

1.02 REFERENCE STANDARDS

- A. UL (DIR) - Online Certifications Directory Current Edition.

1.03 SUBMITTALS

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

1.04 QUALITY ASSURANCE

- A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

PART 2 PRODUCTS

2.01 KITCHEN APPLIANCES

- A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.
- B. Ice Machine: Countertop touch-free nugget ice machine / dispenser; air cooled with integrated anti-microbial surfaces.
 - 1. Basis of Design: Scotsman HID312A-1
 - 2. Ice Production: 250 to 260 pounds per day.
 - 3. Ice Storage Capacity: 12 pounds.
 - 4. Electrical: 115 volts, 60Hz, 3 amps.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify utility rough-ins are provided and correctly located.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Anchor built-in equipment in place.

3.03 ADJUSTING

- A. Adjust equipment to provide efficient operation.

3.04 CLEANING

- A. Remove packing materials from equipment and properly discard.
- B. Wash and clean equipment.

END OF SECTION 113013

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SECTION 123600 COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Countertops for architectural cabinet work.
- B. Solid surface fabrications.

1.02 RELATED REQUIREMENTS

- A. Section 064100 - Architectural Wood Casework.
- B. Section 064113 - Wood-Veneer-Faced Architectural Cabinets

1.03 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard 2022.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications 2022.
- C. ANSI/AWI 0620 - Finish Carpentry/Installation 2018.
- D. ANSI/AWI 1236 - Architectural Woodwork Institute (AWI) Standards for Countertops 2022.
- E. AWI (QCP) - Quality Certification Program Current Edition.
- F. AWI 300 - Materials 2018.
- G. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.
- H. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- I. PS 1 - Structural Plywood 2019.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.05 QUALITY ASSURANCE

- A. Quality Certification:
 - 1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
 - 2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
 - 3. Provide designated labels on shop drawings as required by certification program.
 - 4. Provide designated labels on installed products as required by certification program.
 - 5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - a. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings, or a comparable Architect-approved product by one of the following:
 - 1) Formica Corporation: www.formica.com/#sle.
 - 2) Lamin-Art, Inc: www.laminart.com/#sle.
 - 3) Panolam Industries International, Inc: www.panolam.com/#sle.
 - 4) Wilsonart: www.wilsonart.com/#sle.
 - b. Surface Color and Pattern: As indicated on drawings.
 - 2. Exposed Edge Treatment: PVC edge-banding, 0.12 inch thick; color to match plastic laminate,
 - 3. Back and End Splashes: Same material, same construction.
 - 4. Fabricate in accordance with ANSI/AWI 1236, Custom Grade.
- C. Solid Surfacing Fabrications, including counters, Type SS1: Solid surfacing sheet or plastic resin casting.
 - 1. Flat Sheet Thickness: As indicated on Drawings.
 - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) Dupont: www.corian.com/#sle.
 - 2) Formica Corporation: www.formica.com/#sle.
 - 3) Basis of Design: Wilsonart: www.wilsonart.com/#sle.
 - b. Color and Pattern: As indicated on Drawings.
 - 3. Exposed Edge Treatment: Radiused edge.
 - 4. Fabricate in accordance with applicable requirements of ANSI/AWI 0620, Custom Grade.

2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
- C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.

2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.

2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
 2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and fabricate solid surface fabrications up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

- A. Comply with applicable requirements of AWI (QCP), ANSI/AWI 0620 and ANSI/AWI 1236.
- B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- C. Securely attach solid surface fabrications as indicated on Drawing.
- D. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- E. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.05 CLEANING

- A. Clean countertops surfaces thoroughly.

3.06 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Coordination of AWI inspection:
 1. Provide inspection in compliance with AWI (QCP).
 2. Notify AWI in writing of schedule for woodwork to be certified, and allow adequate time for inspection.
 3. Cooperate with AWI.
 4. Allow access to woodwork to be inspected.
- C. Inspection entity is to prepare and submit report of inspection.

3.07 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 123600

**SECTION 134813
MANUFACTURED SOUND AND VIBRATION CONTROL COMPONENTS**

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. Resilient sound isolation clips for interior partitions.
- B. Related Requirements:
 - 1. Section 092116 - Gypsum Board Assemblies:
 - a. For non-structural steel framing and suspension systems that support gypsum board panels.
 - b. For applying and finishing gypsum board panels over non-structural metal framing.

1.03 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated load, rated deflection, and overload capacity for each sound and vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of sound and vibration isolation device type required.
- B. Shop Drawings:
 - 1. Include plans, sections, and mounting details.
 - 2. Include locations and selections of sound and vibration devices.
 - 3. Include details of system assemblies and equipment. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - a. Include non-structural metal framing system systems for interior partitions.
- C. Delegated-Design Submittal: For each sound and vibration isolation device.
 - 1. Include design calculations for selecting sound and vibration components.
- D. Coordination Drawings: Show coordination of sound and vibration isolation device installation for system assemblies and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: The design for manufactured sound and vibration control components is based on products indicated in other Part 2 articles. Subject to compliance with requirements, provide the named product, or a comparable product by another qualified manufacturer, including but not limited to the following:
 - 1. Kinetics Noise Control, Inc.
 - 2. Mason Industries, Inc.
 - 3. Pliteq, Inc.
 - 4. Vibration Mountings & Controls, Inc.

2.02 SYSTEM DESCRIPTION

- A. Sound and Vibration Isolation Devices: Sound and vibration isolation devices shall be designed to operate within the strain limits of the isolator to provide the maximum isolation and longest life expectancy possible. Sound and vibration isolation devices shall be capable of withstanding the design loads in all directions with no metal-to-metal contact. Isolator sizes shall be selected to not exceed published load capacities.

- B. Resilient Sound Isolation Clips for Partitions: Resilient sound isolation clips shall support gypsum board panels and furring support channels attached to non-structural metal framing for interior partitions. Resilient sound isolation clips shall have sufficient capacity to sustain continuously applied gypsum board panels weight without settling after initial deflection.

2.03 RESILIENT SOUND ISOLATION CLIPS

- A. Resilient Isolation Hangers:
1. Basis-of-Design Product: Subject to compliance with requirements, provide the following product, or an approved equal product by another qualified manufacturer.
 - a. Pliteq, Inc.; GenieClip RST, Resilient Sound Isolation Clip.
 2. Description: Resilient sound isolation clip shall be a unibody molded rubber and galvanized steel mount part designed for support of gypsum board panels and for noise control (de-coupling) in walls and ceilings.
 3. Dimensions: 1-5/8 inch wide by 2-1/2 inches high, by 1 inch deep.
 - a. Projection: 1-5/8 inch projection from supporting structure when 7/8 inch metal furring channels are used.
 4. Physical Properties:
 - a. Maximum Design Load: 36 lbf. per clip.
 - b. Ultimate Load Before Failure: As follows, tested in accordance with ASTM D1761.
 - 1) 445 lbf. in direct withdrawal.
 - 2) 229 lbf. in lateral resistance (shear).
 - c. Tensile Strength: 11.2 MPa, minimum, per ASTM D412, Die C.
 - d. Elongation at Break: 454 percent, minimum, per ASTM D573.
 - e. Type A Hardness: 37 durometer, per ASTM D2240.
 - f. Dynamic Stiffness: 11.3 N/mm, per ASTM D5992, ASTM D4473, ASTM D4065.
 - g. Dynamic-Static Stiffness Ratio: 1.19, per ASTM D5992, ASTM D4473, ASTM D4065.
 - h. Temperature Stability: Minus 40 degrees F to plus 240 degrees F.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine areas and equipment to receive sound and vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SOUND AND VIBRATION CONTROL DEVICE INSTALLATION

- A. Install sound and vibration control devices complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Installation of vibration isolators must not cause any change of position of system assemblies or equipment resulting in stresses or misalignment.

END OF SECTION 134813

SECTION 142100
ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electric traction elevator systems for public elevators.

1.02 RELATED REQUIREMENTS

- A. Section 142400 - Hydraulic Elevators: For staff and detention elevators.
- B. Section 211300 - Fire-Suppression Sprinkler Systems.
- C. Section 260533.13 - Conduit for Electrical Systems: Electrical conduit requirements.
- D. Section 260583 - Wiring Connections: Wiring connection requirements.
- E. Section 282000 - Video Surveillance: Installation of video camera in car interior for security monitoring.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. AISC 360 - Specification for Structural Steel Buildings 2022.
- D. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).
- E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- F. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices 2019, with Errata (2021).
- G. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, and Dumbwaiters 2020.
- H. ASME QEI-1 - Standard for the Qualification of Elevator Inspectors 2018.
- I. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- J. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.
- K. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- L. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- O. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- P. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- Q. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification 2021.
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).

- S. ITS (DIR) - Directory of Listed Products Current Edition.
- T. NEMA MG 1 - Motors and Generators 2021.
- U. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- V. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- W. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- X. PS 1 - Structural Plywood 2019.
- Y. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other installers to provide necessary conduits and wiring for proper installation of wiring, including but not limited to, the following:
 - a. Elevator equipment devices remote from elevator or hoistway.
 - b. Remote group automatic panel in lobby from controller cabinet.
 - c. Video Surveillance Camera and other security equipment.
 - d. Elevator pit for lighting and sump pump.
 - e. Automatic transfer switch from controller cabinet.
 - f. Fire alarm panel from controller cabinet.
 - 2. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
 - a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
 - b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation; include provisions for shunt trip power monitoring.
 - 3. Coordinate installation of electric traction elevators with hydraulic elevators.
- B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
 - 1. Review schedule of installation, proper procedures and conditions, and coordination with related work.
 - 2. Review use of elevator for construction purposes, hours of use, scheduling of use, cleanliness of car, employment of operator, and maintenance of system.
- C. Construction Use of Elevator: Provide designated elevator for transport of construction personnel and materials in compliance with ASME A17.1. Coordinate with Section 142400.
 - 1. Make elevator available for construction use as early as possible.
 - 2. Enclose car with protective plywood on floor, walls, and ceiling.
 - 3. Provide temporary lighting.
 - 4. Provide control panel with manual and emergency operation.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit data on following items:
 - 1. Signal and operating fixtures, operating panels, and indicators.
 - 2. Car design, dimensions, layout, and components.
 - 3. Car and hoistway door and frame details.
 - 4. Electrical characteristics and connection requirements.
- C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
 - 1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.

2. Hoistway Components: Size and location of car machine beams, guide rails, buffers, ropes, and other components.
 3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
 4. Clearances and over-travel of car and counterweight.
 5. Locations in hoistway of traveling cables and connections for car lighting, telephone, video camera, and security equipment.
 6. Location and sizes of hoistway and car doors and frames.
 7. Electrical characteristics and connection requirements.
 8. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
- D. Samples: Submit samples illustrating car floor material, car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets or finish color selection brochures.
- E. Installer's Qualification Statement.
- F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design guide rails under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in Idaho.
- B. Installer Qualifications: Supervisor along with trained elevator installation personnel on staff of elevator equipment manufacturer.
- C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- E. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
- F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Electric Traction Elevators:
 1. Basis of Design: Schindler Elevator Corporation; Schindler 3300 Low-Rise MRL: www.us.schindler.com/#sle.
 2. Acceptable Alternate: Otis Elevator Company: www.otis.com/#sle.
 - a. Verify dimensions and other requirements.
- B. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier.

2.02 ELECTRIC TRACTION ELEVATORS

- A. Machineroom-less Electric Traction Passenger Elevator, 1.108 A/C and 1.109 B/D:
1. Electric Traction Elevator Equipment:
 - a. Gearless Traction Machine: Single wrapped traction driving sheave, with dual brake.
 2. Drive System: Regenerative.
 3. Operation Control Type:
 - a. Selective Collective Automatic Operation Control.
 4. Service Control Type:
 - a. Standard service control only.
 5. Interior Car Height: 93 inch.
 6. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
 7. Rated Net Capacity: 3500 pounds.
 8. Rated Speed: 150 feet per minute.
 9. Hoistway Size: As indicated on drawings.
 10. Interior Car Platform Size: As indicated on drawings.
 11. Elevator Pit Depth: 60 inch.
 12. Overhead Clearance at Top Floor: 151 inch.
 13. Travel Distance: As indicated on drawings.
 14. Number of Stops: As indicated on drawings.
 15. Number of Openings: One Front.
 16. Traction Machine Location: Top of hoistway shaft.

2.03 COMPONENTS

- A. Elevator Equipment:
1. Motors, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70 requirements, and see Section 260583 for additional information.
 2. Guide Rails, Cables, Counterweights, Sheaves, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
 3. Buffers:
 4. Lubrication Equipment:
 - a. Provide grease fittings for periodic lubrication of bearings.
 - b. Grease Cups: Automatic feed type.
 - c. Lubrication Points: Visible and easily accessible.
- B. Electrical Equipment:
1. Motors: NEMA MG 1.
 2. Boxes, Conduit, Wiring, and Devices: Comply with NFPA 70 requirements, and see Sections 260533.13 and 260583 for additional information.
 3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
 4. Include wiring and connections to elevator devices remote from hoistway. See Section 260583.

2.04 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
- B. Accessibility Requirements: Comply with ADA Standards.
- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Comply with seismic design requirements in accordance with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
1. Comply with Elevator Safety Requirements for Seismic Risk Zone in accordance with ASME A17.1, ASCE 7 and other related requirements.

2. Provide earthquake emergency operations in accordance with ASME A17.1 requirements.
3. Provide seismic switch in accordance with ASME A17.1 and ASCE 7 requirements.
- E. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- F. Fabricate and install door and frame assemblies in accordance with NFPA 80 and complying with requirements of authorities having jurisdiction (AHJ).
- G. Perform electrical work in accordance with NFPA 70.
- H. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ). See Section 211300.

2.05 OPERATION CONTROLS

- A. Elevator Controls: Provide landing operating panels.
 1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
 2. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building security, including cameras for monitoring elevators, fire alarm, smoke alarm, and building management control systems.
 1. Coordinate camera and camera connections with installer.
- C. Door Operation Controls:
 1. Program door control to open doors automatically when car arrives at floor landing.
 2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
 3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

2.06 OPERATION CONTROL TYPE

- A. Selective Collective Automatic Operation Control: Applies to car in single elevator shaft.
 1. Refer to description provided in ASME A17.1.
 2. Automatic operation by means of one button in the car for each landing served and by "UP" and "DOWN" buttons at the landings.
 3. Stops are registered by momentary actuation of landing car buttons without consideration of the number of buttons actuated or the sequence buttons are actuated, but the stops are made in the order that landings are reached in each direction of travel.
 4. All "UP" landing calls are made when car is traveling in the up direction.
 5. All "DOWN" landing calls are made when car is traveling in the down direction.
 6. Uppermost and lowermost calls are answered as soon as they are reached without consideration of the car travel direction.
- B. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control: Applies to cars in two elevator shafts.
 1. Park one car at main floor and designate other as free car, at landing last served or at a predetermined upper floor landing.
 2. Arrange free car to answer landing calls either above or below landing where car is standing except main floor and basement landing calls.
 3. When free car is answering calls, automatically start an alternate car to answer landing calls under any of the following conditions:
 - a. Registration of up calls from landings below the free car while it is traveling up by alternate car below.
 - b. Registration of up or down calls from landings above the free car while it is traveling down by alternate car.
 - c. Free car fails to clear registered landing calls within 40 seconds, or to move alternate car in response to registered landing calls within this time frame.
 4. Register and answer calls by momentary pressure on one or more car buttons; cause car to respond.

5. Once started, either in response to car button calls, or to landing button calls, respond to calls registered for the direction of the traveling car in the order that landings are reached, regardless of sequence that calls were registered.
6. Allow only one car to stop in response to any one landing call.
7. Return first free car to main floor after answering landing calls.
8. Should both cars finish their calls at main floor, designate one car as the free car.
9. If no car buttons are pressed and car starts up in response to several landing down calls, proceed first to the highest landing down call, then reverse to collect other landing down calls. Collect up calls similarly when car starts down in response to such calls.
10. If a car stops for a landing call, and car button matching direction the car was traveling is pressed within a predetermined time interval after a landing stop, proceed in the same direction regardless of other landing calls that are registered.
11. If down landing buttons are pressed while car is traveling up, do not stop at those landings but allow those calls to remain registered for answering by the next down traveling car.
12. After the highest car has responded to up landing calls, reverse car automatically and respond to down landing calls.
13. When traveling down, a car will not respond to up calls. Allow those up calls to remain registered to be answered by next available car on an up trip.
14. Include a time delay to hold car for an adjustable time interval at landings where stops are made to enable passengers to enter or leave the car. Cancel the time interval upon registration of a car call or pressure on the car door close button.
15. Permit a registered car call to establish the direction of travel when a car has answered the farthest car call, even if other landing calls are registered.
16. Answer calls to the basement landing with the car that is normally parked at the main floor unless the free car is at the basement.
17. If a car is removed from service, the other car shall answer landing calls.

2.07 EMERGENCY POWER

- A. Set-up elevator operation to run with building emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.
- B. Building Emergency Power Supply: Supplied by backup generator; provide elevator system components as required for emergency power characteristics with phase rotation the same as for normal power.
 1. Provide transfer switches and auxiliary contacts.
 2. Install connections to power feeders.
- C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.
- D. Provide operational control circuitry for adapting the change from normal to emergency power.
- E. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.08 MATERIALS

- A. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.
- B. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.
- C. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.
- D. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
- E. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.
- F. Aluminum Sheet: ASTM B209/B209M, 3105 alloy, O temper.
- G. Plywood: PS 1, Structural I, Grade C-D or better, sanded.

- H. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.
- I. Resilient Flooring: Vinyl tile flooring, see Section 096500, Type ____.

2.09 CAR AND HOISTWAY ENTRANCES

- A. Elevator, 1.108 A/C and 1.109 B/D:
 - 1. Car and Hoistway Entrances, Main Elevator Lobby:
 - a. Framed Opening Finish and Material: Alkyd enamel on steel.
 - b. Car Door Material: Powder coat on steel, with rigid sandwich panel construction.
 - c. Hoistway Door Material: Powder coat on steel, with rigid sandwich panel construction.

2.10 CAR EQUIPMENT AND MATERIALS

- A. Elevator Car, 1.108 A/C and 1.109 B/D:
 - 1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons and alarm button.
 - a. Panel Material: Integral with front return; one per car.
 - b. Car Floor Position Indicator: Above door with illuminating position indicators.
 - c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
 - 2. Flooring: Resilient vinyl tile.
 - 3. Front Return Panel: Match material of car door.
 - 4. Door Wall: Stainless steel.
 - 5. Side Walls: Plastic laminate on plywood.
 - 6. Rear Wall: Plastic laminate on plywood.
 - 7. Hand Rail: Stainless steel, at three side walls. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
 - a. Round, Metal Tube: 1-1/2 inch diameter.
 - b. Stainless Steel Finish: No. 4 Brushed.
 - 8. Ceiling:
 - a. Canopy Ceiling: Stainless steel.
 - b. Lighting: Manufacturer's LED.
- B. Car Accessories:
 - 1. Certificate Frame: Stainless steel frame glazed with clear tempered glass, and attached with tamper-proof screws.
 - 2. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set for each elevator.
 - a. Color: Tan.
 - b. Provide at least 4 inch clearance from bottom of pad to finished floor.
 - c. Pad Supports: Stainless steel studs, and mounted from ceiling frame.
- C. Security Cameras: Specified in Section 282000. Coordinate with subcontractor providing equipment, wiring, and installation.

2.11 MACHINE ROOM FITTINGS

- A. Monitoring Device Interface:
 - 1. Fabricate one multiple terminal block in controller relay panel or selector, in location indicated, for connection of monitoring devices for:

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting this work.
- B. Verify that hoistway and pit are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of elevator components. See Section 015000 - Temporary Facilities and Controls for additional requirements.
- B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.
- C. Provide conduit, electrical boxes, wiring, cabling, and accessories; see Sections 260533.13 and 260583.
- D. Mount machines and motors on vibration and acoustic isolators.
 - 1. Place on structural supports and bearing plates.
 - 2. Securely fasten to building supports.
 - 3. Prevent lateral displacement.
- E. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.
- F. Install guide rails to allow for expansion and contraction movement of guide rails.
- G. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
- H. Bolt or weld brackets directly to structural steel hoistway framing.
- I. Field Welds: Chip and clean away oxidation and residue with wire brush; spot prime with two coats.
- J. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
- K. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime with two coats.
- L. Machine Room Components: Clean and degrease; prime one coat, finish with one coat of enamel.
- M. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.
- N. Coordinate installation of security cameras, including traveling cable, with subcontractor providing work of 282000.
- O. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
- B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.

- B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI 1 will be performed at their discretion.
 - 1. Schedule tests with agencies and notify Owner and Architect.
 - 2. Document regulatory agency tests and inspections in accordance with requirements.
 - 3. Perform tests required by regulatory agencies.
 - 4. Furnish test and approval certificates issued by authorities having jurisdiction (AHJ).
- C. Perform testing and inspection in accordance with requirements.
 - 1. Inspectors shall be certified in accordance with ASME QEI-1.
 - 2. Provide at least two weeks written notice of date and time of tests and inspections.
 - 3. Supply instruments and execute specific tests.
- D. Operational Tests:
 - 1. Perform operational tests in the presence of Owner and Architect.
 - 2. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
 - a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.

3.06 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
- B. Remove protective coverings from finished surfaces.
- C. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals for closeout submittals.
- B. Demonstrate proper operation of equipment to Owner's designated representative.

3.09 PROTECTION

- A. Do not permit construction traffic within car after cleaning.
- B. Protect installed products until Date of Substantial Completion.
- C. Touch-up, repair, or replace damaged products and materials before Date of Substantial Completion.

END OF SECTION 142100

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**SECTION 142400
HYDRAULIC ELEVATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Complete hydraulic elevator systems.
 - 1. Detention use.
 - 2. Staff use.

1.02 RELATED REQUIREMENTS

- A. Section 142100 - Electric Traction Elevators: Public elevators.
- B. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in hoistway.
- C. Section 260533.13 - Conduit for Electrical Systems:
- D. Section 260583 - Wiring Connections:
- E. Section 282000 - Video Surveillance: Installation of video surveillance camera in car interior for security monitoring.
- F. Section 284600 - Fire Detection and Alarm:
 - 1. Fire and smoke detectors and interconnecting devices.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. AISC 360 - Specification for Structural Steel Buildings 2022.
- D. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).
- E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- F. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices 2019, with Errata (2021).
- G. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, and Dumbwaiters 2020.
- H. ASME QEI-1 - Standard for the Qualification of Elevator Inspectors 2018.
- I. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- J. ASTM A139/A139M - Standard Specification for Electric-Fusion (Arc)-Welded Steel Pipe (NPS 4 and Over) 2022.
- K. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes 2017.
- L. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- M. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- N. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates 2015 (Reapproved 2021).
- O. ASTM A793 - Standard Specification for Rolled Floor Plate, Stainless Steel 2014.

- P. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- Q. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- R. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- S. NEMA MG 1 - Motors and Generators 2021.
- T. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- U. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- V. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- W. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
 - a. Elevator equipment devices remote from elevator machine room or hoistway.
 - b. Remote group automatic panel from controller cabinet.
 - c. Telephone service for machine room.
 - d. Elevator pit for lighting and sump pump.
 - e. Automatic transfer switch from controller cabinet.
 - f. Video Surveillance Camera and other security equipment.
 - g. Fire alarm panel from controller cabinet.
 - 2. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
 - a. Automatic transfer switches with auxiliary contacts for emergency power transfer status indication.
 - b. Shunt trip devices for automatic disconnection of elevator power prior to fire suppression system activation.
 - c. Overcurrent protection devices selected to achieve required selective coordination.
- B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
 - 1. Review schedule of installation, proper procedures and conditions, and coordination with related work.
 - 2. Review use of elevator for construction purposes, hours of use, scheduling of use, cleanliness of car, employment of operator, and maintenance of system.
- C. Construction Use of Elevator: Provide designated elevator for transport of construction personnel and materials in compliance with ASME A17.1. Coordinate with Section 142100.
 - 1. Make elevator available for construction use as early as possible.
 - 2. Enclose car with protective plywood on floor, walls, and ceiling.
 - 3. Provide temporary lighting.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit data on following items:
 - 1. Signal and operating fixtures, operating panels, and indicators.
 - 2. Car design, dimensions, layout, and components.
 - 3. Car and hoistway door and frame details.
 - 4. Electrical characteristics and connection requirements.

- C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:
 - 1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
 - 2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
 - 3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
 - 4. Individual weight of principal components; load reaction at points of support.
 - 5. Clearances and over-travel of car.
 - 6. Locations in hoistway and machine room of traveling cables and connections for car lighting, telephone, video camera, and security equipment.
 - 7. Location and sizes of hoistway and car doors and frames.
 - 8. Calculated heat dissipation of elevator equipment in machine room.
 - 9. Applicable seismic design data; certified by a licensed Professional Structural Engineer.
 - 10. Interface with building security system.
 - 11. Electrical characteristics and connection requirements.
 - 12. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
- D. Testing Agency's Qualification Statement.

1.06 QUALITY ASSURANCE

- A. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in Idaho.
- B. Installer Qualifications: Trained personnel and supervisor on staff of elevator equipment manufacturer.
- C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing agency acceptable to authorities having jurisdiction as suitable for the purpose indicated in construction documents.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Hydraulic Elevator Manufacturers:
 - 1. Schindler Elevator Corporation; 330A Holeless Hydraulic Elevator: www.schindler.com/#sle.
 - 2. Acceptable Alternate: Otis Elevator Company: www.otis.com/#sle.
 - a. Verify dimensions and other requirements.
- B. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier.

2.02 HYDRAULIC ELEVATORS

- A. Hydraulic Elevator, 10.201 A/B/C (Staff):

1. Hydraulic Elevator Equipment:
 - a. Holeless hydraulic with cylinder mounted within hoistway.
 2. Operation Control Type:
 - a. Selective Collective Automatic Operation Control.
 3. Service Control Types:
 - a. Standard service control.
 4. Interior Car Height: As indicated on Drawings.
 5. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
 6. Rated Net Capacity: 4000 pounds.
 7. Rated Speed: 150 feet per minute.
 8. Hoistway Size: As indicated on drawings.
 9. Interior Car Platform Size: As indicated on drawings.
 10. Elevator Pit Depth: 48 inch.
 11. Overhead Clearance at Top Floor: 171 inch.
 12. Travel Distance: 30.5 feet.
 13. Number of Stops: As indicated on drawings.
 14. Number of Openings: One Front in each elevator.
 15. Hydraulic Equipment Location: As indicated on drawings
- B. Hydraulic Elevator, 2.504 G/H; 2.504 A/C/E, and 2.504 B/D/F (Detention):
1. Hydraulic Elevator Equipment:
 - a. Holeless hydraulic with cylinder mounted within hoistway.
 2. Drive System:
 - a. Variable voltage variable frequency (VVVF) to modulate motor speed.
 3. Service Control Types:
 - a. Restricted Access service control. Coordinate with security requirements.
 4. Interior Car Height: 93 inch.
 5. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
 6. Rated Net Capacity: 5000 pounds.
 7. Rated Speed: 150 feet per minute.
 8. Hoistway Size: As indicated on drawings.
 9. Interior Car Platform Size: As indicated on drawings.
 10. Elevator Pit Depth: 48 inch.
 11. Overhead Clearance at Top Floor: 144 inch.
 12. Travel Distance: 33 feet.
 13. Number of Stops: As indicated on drawings.
 14. Number of Openings: One Front.
 - a. 2.504 G/H: One Front; one Rear.
 - b. 2.504 A/C/E, and 2.504 B/D/F: One Front.
 15. Hydraulic Equipment Location: As indicated on drawings

2.03 COMPONENTS

- A. Elevator Equipment All):
1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70; see Section 260583.
 2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
 3. Buffers:
 - a. Spring type for elevators with speed less than or equal to 200 fpm.
 4. Lubrication Equipment:
 - a. Provide grease fittings for periodic lubrication of bearings.
 - b. Grease Cups: Automatic feed type.
 - c. Lubrication Points: Visible and easily accessible.

- B. Electrical Equipment (All):
 - 1. Motors: NEMA MG 1.
 - 2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70; see Sections 260533.13 and 260583.
 - 3. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.
 - 4. Include wiring and connections to elevator devices remote from hoistway and between elevator machine room. Provide additional components and wiring to suit machine room layout. See Section 260583.

2.04 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
- B. Accessibility Requirements: Comply with ADA Standards.
- C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
- D. Comply with seismic design requirements in accordance with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
 - 1. Complying with Elevator Safety Requirements for Seismic Risk Zone in accordance with ASME A17.1, ASCE 7 and other related requirements.
 - a. Project Seismic Risk: As indicated on drawings.
 - 2. Provide earthquake emergency operations in accordance with ASME A17.1 requirements.
- E. Perform welding of steel in accordance with AWS D1.1/D1.1M.
- F. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.
- G. Perform electrical work in accordance with NFPA 70.
- H. Comply with venting or pressurization of hoistway design in accordance with HVAC system requirements and authorities having jurisdiction (AHJ).
- I. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ). See Section 211300.

2.05 OPERATION CONTROLS

- A. Elevator Controls:
 - 1. Elevators 10.201 A/B/C (Staff):
 - a. Provide landing operating panels and landing indicator panels
 - b. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
 - c. Landing Indicator Panels: Illuminating.
 - d. Comply with ADA Standards for elevator controls.
 - 2. Elevators 2.504 G/H; 2.504 A/C/E, and 2.504 B/D/F (Detention):
 - a. Provide landing operating panels and landing indicator panels
 - b. Landing Operating Panels: Coordinate with security requirements. .
 - c. Coordinate Detention Car controls with security system.
 - d. Comply with ADA Standards for elevator controls.
- B. Interconnect elevator control system with building security, including video surveillance cameras for monitoring elevator, fire alarm, card access, smoke alarm, and building management control systems.
- C. Door Operation Controls:
 - 1. Elevators 10.201 A/B/C (Staff):
 - a. Program door control to open doors automatically when car arrives at floor landing.

- b. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
- c. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.
2. Elevators 2.504 G/H; 2.504 A/C/E, and 2.504 B/D/F (Detention):
 - a. Key Switch Feature: Car and hall push buttons are activated and deactivated by security key switch. Key is removable only in deactivated position..
 - b. Remote Switch Operator: Car is operated by a remote touch screen operations located at control station to be located at Officer Station 1.304.
 - c. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.
- D. Monitoring Panel:
 1. Locate status indicator and control panel for each individual elevator and group of elevators as indicated on drawings.
 2. Mount panel in console as indicated on drawings.
 3. Coordinate size and style of panel with console manufacturer.
 4. Etch face plate markings in panel, and fill with paint of contrasting color.
 5. Include direction indicator displaying landing "Up" and "Down" calls registered at each landing floor.
 6. Include position and motion display for direction of travel of each elevator. Display appropriate graphic characters on non-glare screen. Indicate position of cars at rest and in motion.
 7. Include a "Remove From In Service" switch for each elevator that then calls car to ground floor and parks car with doors open.
 8. Include emergency power selector switch for each group of elevators that overrides automatic emergency power selection.
 9. Include "Firefighter's Service Switch" that manually recalls each elevator to main floor.
- E. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).
 1. Designated Landing: Main Lobby.

2.06 OPERATION CONTROL TYPE

- A. Elevators 10.201 A/B/C (Staff):
 1. Single Automatic (Push Button) Operation Control: Applies to car in single elevator shaft.
 - a. Refer to description provided in ASME A17.1.
 - b. Set system operation so that momentary pressure of landing button dispatches car from other landing to that landing.
 - c. Allow call registered by momentary pressure of landing button at any time to remain registered until car stops in response to that landing call.
 - d. If elevator car door is not opened within predetermined period of time after car has stopped at terminal landing allow car to respond to call registered from other landing.
 2. Elevators 2.504 G/H; 2.504 A/C/E, and 2.504 B/D/F (Detention):
 - a. Remote Security Control: Applies to car in single elevator shaft.

2.07 SERVICE CONTROL TYPE

- A. Restricted Access Service Control (Detention): Coordinate with security requirements

2.08 EMERGENCY POWER

- A. Set-up elevator operation to run with building emergency power supply when the normal building power supply fails, and in compliance with ASME A17.1 requirements.
- B. Building Emergency Power Supply: Supplied by backup generator; provide elevator system components as required for emergency power characteristics with phase rotation the same as for normal power.
 1. Provide transfer switches and auxiliary contacts.

2. Install connections to power feeders.
- C. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.
- D. Provide operational control circuitry for adapting the change from normal to emergency power.
- E. After the transfer of emergency power and advancement of elevators to landings has completed one cycle, operate one pre-selected elevator in normal operation using the emergency power supply.
 1. If the pre-selected car fails to operate, automatically select another car to operate.
 2. Provide manual switch to override the automatic selection process.

2.09 MATERIALS

- A. Steel Cylinder Casing: ASTM A139/A139M, Grade A steel.
- B. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.
- C. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.
- D. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish.
- F. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.
- G. Rolled Stainless-Steel Floor Plate: ASTM A793.
- H. Tempered Glass: 3/8 inch minimum thickness, fully tempered in compliance with ASME A17.1, 16 CFR 1201, ANSI Z97.1, and ASTM C1048 tempered glass requirements.

2.10 CAR AND HOISTWAY ENTRANCES

- A. Elevator: All Elevators
 1. Car and Hoistway Entrances, Each Elevator Floor Lobby:
 - a. Framed Opening Finish and Material: Brushed stainless steel.
 - b. Car Door Material: Stainless steel, with rigid sandwich panel construction.
 - c. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
 - d. Door Operation: Side opening, two speed.
 - e. Door Width: As indicated on drawings.
 - f. Door Height: As indicated on drawings.
 - g. Sills: Manufacturer's standard.
- B. Sills/Thresholds: Configure to align with frame return and coordinate with floor finish.
- C. Gasketing: Provide acoustic type gasketing at hoistway doors and frames to eliminate audible noise due to car activities in the hoistway, and air pressure differential between hoistway and landing floors.

2.11 CAR EQUIPMENT AND MATERIALS

- A. Elevator Cars 10.201 A/B/C (Staff):
 1. Car Operating Panel: Provide main; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons and alarm button.
 - a. Provide service cabinet, with hinged door and keyed lock in each car.
 - b. Provide following within service cabinet as part of car operating panel:
 - 1) Switch for each auxiliary operational control, keyed.
 - 2) Switches for fan, light, and inspection control.
 - 3) Emergency light.
 2. Ventilation: Single speed fan with grille in ceiling.
 3. Flooring: Resilient vinyl tile.
 4. Front Return Panel: Stainless steel.
 5. Door Wall: Stainless steel.
 6. Ceiling: Satin stainless steel, No. 4 finish. .

- B. Elevator Cars, 2.504 G/H; 2.504 A/C/E, and 2.504 B/D/F (Detention):
 - 1. Car Operating Panel: Provide vandal resistant options for detention use.
 - 2. Ventilation: Single speed fan with perforations in wall base.
 - 3. Flooring: Steel diamond floor plate, ASTM A786/A786M.
 - 4. Front Return Panel: Stainless steel.
 - 5. Door Wall: Stainless steel.
 - 6. Ceiling:
 - a. Canopy Ceiling: Stainless steel.
 - b. Lighting: As selected from manufacturer's standard line.
- C. Car Accessories:
 - 1. Certificate Frame (in Staff elevators): Stainless steel frame glazed with tempered glass, and attached with tamper-proof screws.
- D. Security Cameras: Specified in Section 282000. Coordinate with subcontractor providing equipment, wiring, and installation.

2.12 MACHINE ROOM FITTINGS

- A. Wall-Mounted Frames: Glazed with clear plastic; sized as required. Provide one chart each for master electric and hydraulic schematic and for lubrication chart. Install charts.
- B. Key Cabinet: Wall-mounted, lockable, keyed to building keying system, for control and operating panel keys.
- C. Monitoring Device Interface:
 - 1. Fabricate one multiple terminal block in controller relay panel or selector, in location indicated, for connection of monitoring devices for:
 - a. Landing and car registration circuits.
 - b. Motor generator running circuits.
 - c. Load weighing circuits.
 - d. Up and down peak programming circuits.
 - e. Independent service switches.
 - 2. Label terminals for use with alligator test clips.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting this work.
- B. Verify that hoistway, pit, and machine room are ready for work of this section.
- C. Verify hoistway shaft and openings are of correct size and within tolerance.
- D. Verify location and size of machine foundation and position of machine foundation bolts.
- E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

- A. Arrange for temporary electrical power for installation work and testing of elevator components; see Section 015000 - Temporary Facilities and Controls for additional requirements.
- B. Maintain elevator pit excavation free of water.
- C. Maintain in-ground elevator shaft excavation free of water.

3.03 INSTALLATION

- A. Coordinate this work with installation of hoistway wall construction.
- B. Install system components, and connect equipment to building utilities.
- C. Provide conduit, electrical boxes, wiring, cabling, and accessories; see Sections 260533.13 and 260583.
- D. Install hydraulic piping between cylinder and pump unit.

- E. Mount machines, motors, and pumps on vibration and acoustic isolators.
 - 1. Place on structural supports and bearing plates.
 - 2. Securely fasten to building supports.
 - 3. Prevent lateral displacement.
- F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.
- G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.
- H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
- I. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
- J. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.
- K. Wood Surfaces not Exposed to Public View: Finish with one coat primer; one coat enamel.
- L. Coordinate installation of security camera, including traveling cable, with subcontractor providing work of 282000.
- M. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

- A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
- B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI 1 will be performed at their discretion.
 - 1. Schedule tests with agencies and notify Owner and Architect.
 - 2. Obtain permits as required to perform tests.
 - 3. Document regulatory agency tests and inspections in accordance with requirements.
 - 4. Perform tests required by regulatory agencies.
 - 5. Furnish test and approval certificates issued by authorities having jurisdiction.
- C. Perform testing and inspection in accordance with requirements.
 - 1. Inspectors shall be certified in accordance with ASME QEI-1.
 - 2. Perform tests as required by ASME A17.2.
 - 3. Provide at least two weeks written notice of date and time of tests and inspections.
 - 4. Supply instruments and execute specific tests.
- D. Operational Tests:
 - 1. Perform operational tests in the presence of Owner and Architect.
 - 2. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
 - a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.

3.06 ADJUSTING

- A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.
- B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING

- A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

- B. Remove protective coverings from finished surfaces.
- C. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals for closeout submittals.
- B. See Section 017900 - Demonstration and Training for additional requirements.
- C. Demonstrate proper operation of equipment to Owner's designated representative.

3.09 PROTECTION

- A. Do not permit construction traffic within car after cleaning.
- B. Protect installed products until Date of Substantial Completion.
- C. Touch-up, repair, or replace damaged products and materials prior to Date of Substantial Completion.

END OF SECTION 142400

**SECTION 211313
FIRE SPRINKLER SYSTEM**

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of the contract apply to this section.
- B. Technical sections which describe related work such as Division 26 apply to this section.
- C. Division 23 Basic Mechanical Requirements section applies to the work of this section.
- D. Separate sections of Division 23 specify, Hangers and Supports, Expansion Compensation, piping system identification materials and requirements and pipe insulation.

1.02 SUMMARY:

- A. Furnish all materials, equipment and supplies and perform all work and operations to construct and make functional fire sprinkler systems to provide fire protection of all areas of the Theron J Ward Judicial Building. in Twin Falls, UT. The design shall meet the requirements of NFPA 13, Twin Falls Fire Department and be in accordance with the bid drawings and specifications. Reference to other specifications, codes, standards or manuals which are a part of these specifications, but are not included herein, shall be the latest adopted edition of these publications.

1.03 QUALITY ASSURANCE:

- A. Materials, devices and equipment shall be Underwriters Laboratories listed or Factory Mutual approved for use in fire protection systems.
- B. Installer: The sub-contractor for each of the fire protection systems shall be duly licensed by the state of Idaho. The sub-contractor must be engaged in the installation of the types of automatic fire protection systems required for this project and be fully familiar with all local conditions, specified codes and requirements.
- C. Designer: The designer for the fire sprinkler system shall be a staff employee of the "Installer" and shall be a licensed fire protection engineer (Idaho registration) or a Certified Engineering Technician in Fire Protection (NICET level III minimum). The Certification shall be active during the entire contract period. The designer shall certify that the drawings and installation are in accordance with the intent of the plans and specifications. The designer shall make a complete and final inspection of the installation, including operating all alarms, control valves, checking all piping, seismic bracing, hangers, etc. After checking all components of the system, he shall provide a letter stating that the installation is complete, operational and in accordance with approved plans and specifications. If changes have been made in the installation since the plans were approved, the designer shall correct the shop drawings and provide as-built drawings to the Owner with the letter.

1.04 SUBMITTALS:

- A. Shop Drawings: The fire sprinkler contractor shall prepare complete shop drawings for each sprinkler system/zone. Shop drawings shall be coordinated with structure and with all other trades. Show ceiling grid, lights, grilles, ducts, registers and diffusers, smoke detectors, sound speakers, etc. Draw sections to show relative elevations of piping, ductwork, conduit, cable trays, ceiling grid, beams, etc. Show heads symmetrically related to ceiling patterns and show heads centered in tiles in grid. The shop drawings shall contain, as a minimum, the information outlined and listed in NFPA 13. Submit fire sprinkler drawings and hydraulic calculations to each Authority Having Jurisdiction for review prior to starting work. Final design shall incorporate all requirements of the AHJ's. Work only from reviewed documents.
- B. Hydraulic Calculations: Furnish complete hydraulic calculations for the hydraulically most remote area of each different occupancy classification of each fire sprinkler zone.

- C. Descriptive Data: Descriptive data shall be submitted on the following items of material and/or equipment. Such data shall consist of manufacturer's or supplier's catalog information in sufficient detail to allow verification that the material and/or equipment meets the specification requirements, or is equal to that specified.
 - 1. Valves
 - 2. Backflow preventer
 - 3. Floor Control Valve Assemblies
 - 4. Pipe
 - 5. Pipe supports and braces
 - 6. Fittings and couplings
 - 7. Fire Department Connection
 - 8. Sprinklers
 - 9. Valve tamper switches
 - 10. Water flow alarm switches
- D. Submittal Procedure: Submit four sets of drawings and hydraulic calculations to the Architect for review. After review and acceptance by the Architect, submit to Twin Falls City Fire Department for review. Any review comments, and associated drawing revisions, from local approving authorities that affect the system design shall be approved by the Architect prior to installation.
- E. Upon completion of installation submit to Architect two copies each:
 - 1. NFPA 13, "Contractor's Material & Test Certificate for Aboveground Piping." Furnish a separate report for standpipe systems, wet-pipe systems and dry-pipe systems.
 - 2. As-built shop drawings with designer's signature and certification number. As-Built drawings shall be submitted in printed and electronic format.

1.05 WORK INCLUDED:

- A. Fire sprinkler systems per NFPA 13 to protect all areas (existing and new) of the building. Work includes but is not limited to:
 - 1. Design and installation drawings, including hydraulic calculations.
 - 2. Fire sprinkler riser.
 - 3. Floor control valve assemblies to create a minimum of one fire sprinkler zone per level.
 - 4. Demolition of existing fire sprinkler riser and FDC in existing building.
 - 5. Remodel of existing fire sprinkler system in existing building.
 - 6. Pipe, fittings, sway bracing, and supports
 - 7. Test/drain valves and discharge piping.
 - 8. Signs, sprinklers and sprinkler escutcheons
 - 9. Testing and documentation.

1.06 RELATED WORK:

- A. Painting.
- B. Excavation and Backfill.
- C. Electrical Materials and Methods.
- D. Fire Alarm and Detection.

1.07 SYSTEM DESCRIPTION:

- A. Design, furnish and install fire sprinkler system in accordance with NFPA 13 provide fire protection of all areas of the building (existing building and building addition). Work includes but is not limited to the following:
 - 1. Furnish and install 6" fire protection water supply to building. Fire protection water supply shall be installed, flushed and tested in accordance with all applicable provisions of NFPA 13, and NFPA 24. Install fire service to Fire Riser room located along north wall of building expansion.

2. Furnish and install a fire sprinkler riser. Riser shall be complete with butterfly pattern control valves, double check assembly (backflow preventer), 2" main drain and pressure gauges. Refer to riser schematic on contract drawings.
3. Fire sprinkler system shall be subdivided to create a minimum of one separate zone for each floor level. Install a floor control valve assembly on each level or within fire riser room including indicating type, supervised control valve, check valve, vane type water flow switch, pressure gauge and test/drain valve.
4. Demolish fire sprinkler riser and remote, wall mounted Fire Department Connection for existing building. Install new feed main from building addition to provide water supply to fire sprinkler system protecting existing portion of building. Connect to existing cross main for gridded piping system (see drawings).
5. Add and/or relocate fire sprinklers in existing portion of building as required to accommodate remodel and ensure fire sprinkler protection throughout building in accordance with NFPA 13. Refer to Architectural plans to determine scope and extent of remodel. Coordinate with mechanical and electrical systems. Locations of fire sprinklers and piping on drawings is approximate and should be field verified by Contractor.
6. Extend discharge from each test/drain valve back to the fire riser and to the exterior of the building.
7. Piping shall be concealed above ceilings where ceilings are present and may be run exposed in areas without ceilings. Where horizontal piping is exposed, the piping shall be run as high as possible to avoid conflicts with suspended lights and ductwork.
8. Provide fire sprinkler protection for all concealed spaces enclosed wholly or partly by exposed combustible construction or that contain exposed combustible materials.
9. Where practical, install piping to drain back to the floor control valve assemblies. Where piping cannot be pitched to drain to the floor control valves, provide auxiliary drains per NFPA 13 to facilitate drainage of the fire sprinkler piping.
10. The sprinkler systems shall be coordinated with all other trades. Where conflicts arise, it shall be the responsibility of the fire sprinkler contractor to relocate piping or other system devices to an acceptable location.
11. Provide fire sprinklers to protect the bottom of elevator shaft where required by NFPA 13. Provide additional fire sprinklers to protect the top of elevator shaft unless the omission of fire sprinklers at the top of the elevator shafts is permitted in accordance with NFPA 13 8.15.5.6. Coordinate with the fire alarm and elevator contractor to ensure the shutdown of power to elevators equipment prior to the activation of fire sprinklers at the top of elevator shafts or equipment rooms.
12. Piping shall only be installed in areas where temperatures will not drop below 40 °F. If piping must be installed in areas where the temperature is not maintained above 40 °F, the piping must be part of a dry-pipe system in conformance with the requirements of NFPA 13. Small isolated areas subjected to freezing temperatures may be protected by dry-type fire sprinklers supplied from water filled piping in adjacent heated areas.

1.08 SYSTEM DESIGN:

- A. Design densities and areas of application shall meet the minimum requirements of NFPA 13 and Twin Falls Fire Department as outlined below:
 1. Janitor, Mechanical, Electrical, Storage, Fire Riser, Elevator Equipment and similar areas: Ordinary hazard group 2, 0.20 gpm/sq. ft. Over the most remote 1,500 sq. Ft. Including 250 gpm hose allowance.
 2. All other areas: Light hazard, 0.10 gpm/sq. Ft. over the most remote 1,500 sq. ft. Including 100 gpm hose allowance.
- B. Maximum coverage per sprinkler head.
 1. Ordinary Hazard: 130 sq. ft.
 2. Light Hazard: 225 sq. ft.
- C. The design area shall be the hydraulically most remote rectangular area having a dimension parallel to the branch line equal to, or greater than, 1.2 times the square root of the area of sprinkler operation.

- D. Hydraulic calculations for the fire sprinkler system shall extend to the point of connection to the public water system under 6th Avenue (north of building addition). The following pressures and flow may be used for design of the fire sprinkler system:
 - 1. 78 psi
 - 2. Residual Pressure: 64 psi
 - 3. Flow: 1,021 gpm
 - 4. Test Date: 11/10/22
 - 5. Test Location: Gauge Hydrant at Gooding and 6th. Flow Hydrant at 6th and Shoshone
 - 6. Test By: Greg Jones - PCI
- E. Provide a minimum safety factor (in psi) of 10% in hydraulic calculations for fire sprinkler system. Required pressure determined by hydraulic calculations shall not exceed 90% of the pressure values listed above.
- F. Piping in existing portion of building is hydraulically designed to protect a hazard classification of light hazard. No changes to hazard classification will occur. No hydraulic calculations will be required for existing fire sprinkler piping unless specifically required by Twin Falls Fire Department.

1.09 WARRANTY:

- A. Materials, equipment, and workmanship shall be free from defects for 12 months from the "Date Left in Service with All Control Valves Open," shown on "Contractor's Material and Test Certificate." If any Work is found to be defective, Contractor shall promptly, without cost to Owner, and in accordance with Owner's instructions, either correct such defective Work, or if it has been rejected by Owner, remove it from the site and replace it with non-defective Work. Submit two copies of Warranty Certificates to Architect.

1.10 REFERENCES:

- A. NFPA (National Fire Protection Association) 13, "Installation of Sprinkler Systems," 2016.
- B. NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances, 2016
- C. IFC (International Fire Code), 2018
- D. IBC (International Building Code), 2018
- E. Underwriters Laboratories "Fire Protection Equipment Directory," current edition.
- F. Factory Mutual Systems "Approval Guide," current edition.

PART 2 PRODUCTS

2.01 GENERAL

- A. Materials, devices and equipment shall be Underwriters Laboratories listed or Factory Mutual approved for use in fire protection systems.

2.02 PIPE:

- A. Piping shall be black steel and shall meet or exceed the following standards: ASTM A795, ANSI/ASTM A53, ASTM A135, ANSI B36-10M, UL CRR (Corrosion Resistance Rating) minimum 1.0 for threaded pipe.

2.03 FITTINGS:

- A. Steel Piping:
 - 1. Cast iron threaded, ANSI B16.4.
 - 2. Cast iron flanged, ANSI B16.1.
 - 3. Malleable iron threaded, ANSI B16.3.
 - 4. Forged steel fittings, socket welded and threaded, ANSI B16.11.
 - 5. Plain end couplings and fittings, saddle couplings, and clamp type couplings are not acceptable.

6. Other types of fittings may be used, but only those investigated and listed for this service and approved by the project engineer.

2.04 HANGERS:

- A. Hangers shall conform to the minimum requirements of NFPA 13. Coordinate with structural system as required for placement of hangers in concrete structure. No drilling will be permitted for installation of hangers in concrete structural members encasing pre-tensioned steel.

2.05 SEISMIC FITTINGS AND BRACES:

- A. Earthquake bracing is required and shall conform to the minimum requirements of NFPA 13.
- B. All brace members for earthquake bracing assemblies shall be constructed of piping with a minimum wall thickness of schedule 40.

2.06 SPRINKLERS:

- A. All areas with finished ceilings (except inmate holding and transfer areas): Quick response, standard orifice (K-5.6), ordinary temperature, white painted, pendent fire sprinkler with white recessed type escutcheon.
- B. Inmate holding and transfer areas: Quick response, standard orifice (K-5.6), ordinary temperature, white painted, institutional type (tamper-proof) pendent fire sprinkler with white finish and trim plate (Tyco TY3281).
- C. Areas without finished ceilings: Quick response, standard orifice (K-5.6), ordinary or intermediate temperature, brass, upright fire sprinklers.
- D. Fire sprinklers shall be installed in accordance with NFPA 13 and manufacturer's requirements. Specific coordination between the Fire Sprinkler Contractor and any other Contractor is to occur to prevent obstructions to fire sprinkler heads.
- E. Provide a minimum of 12 spare heads in a cabinet and one head wrench for each type sprinkler.

2.07 VALVES:

- A. Fire Sprinkler Riser:
 1. Butterfly pattern system control valves with built-in tamper switches.
 2. Double Check Valve Assembly, listed for horizontal installation, meeting local Fire / Plumbing Code requirements.
 3. 2" angle valve for main drain.
- B. Floor Control Valve Assemblies
 1. Butterfly pattern control valve with built-in supervisory switch.
 2. Swing type check valve
 3. Combination test and drain valve. Provide adjustable orifice and sight glass. Connect discharge of test/drain valve to combination drain and extend back to main drain at fire sprinkler riser.

2.08 FIRE DEPARTMENT CONNECTION:

- A. Wall mounted, polished chrome, 2-way fire department connection including placard and caps. Placard shall read: "AUTO SPKR". Connection shall meet the requirements of Twin Falls Fire Department.

2.09 ALARM DEVICES

- A. Devices are furnished and installed by fire sprinkler contractor and wired by fire alarm contractor.
- B. Fire Sprinkler Systems Riser:
 1. Valve tamper switches: The valve tamper switches shall be SPDT electrical switches rated for 125 Vac for monitoring the position of control. Switches shall be built-in on the butterfly pattern control valves.
- C. Floor Control Valve Assemblies:

1. Valve tamper switch: The valve tamper switch shall be an SPDT electrical switch rated for 125 Vac for monitoring the position of control. Switch shall be built-in on the butterfly pattern control valve.
 2. Water flow switch: Furnish and install a water flow detector, designed for wet pipe sprinkler systems. Detector shall be a vane type water flow switch installed on the system piping downstream of control valve. Activation of switch shall provide actuation of two SPDT switches rated for 125 Vac at water flows of 10 gpm or greater.
- D. Water Flow Bell:
1. Provide and install a 10" electric bell on the exterior of building. Locate the water flow bell on the portion of the wall nearest to the FDC. Location of water flow bell shall be approved by the project architect. Power to bell and wiring to fire alarm systems shall be the responsibility of the fire alarm contractor.

PART 3 EXECUTION

3.01 INSPECTION

- A. Inspect job site prior to fabricating materials. Coordinate and sequence installation with the progress of other mechanical and structural systems and components.

3.02 INSTALLATION

- A. Install systems in compliance with methods detailed in NFPA 13 including seismic requirements for Area 3.
- B. Offset as needed for other trades. Avoid conflict in areas of tight construction. Do not obstruct access to air control boxes, access doors, lights or other ceiling mounted equipment.
- C. Submit piping and equipment data sheets for review by the Architect/Engineer prior to start of the installation.
- D. Close pipe openings with caps or plugs during installation. Cover and protect components of the system against dirt and chemical or mechanical injury.
- E. Provide concrete splash blocks for drains test valve discharge, etc. Concrete splash blocks shall be pre-fabricated, 2-1/2" thick, Amcor or Engineer approved equal.
- F. Piping shall only be installed in areas where temperatures will not drop below 40 °F. If piping must be installed in areas where the temperature is not maintained above 40 °F, the piping must be part of a dry-pipe system in conformance with the requirements of NFPA 13.
- G. Provide chrome plated escutcheons around exposed piping where piping passes through walls or ceilings in a finished area.

3.03 FIELD QUALITY CONTROL

- A. Obtain permits and post bonds as required by state and local AHJ's (Authorities Having Jurisdiction).
- B. Inform AHJ's of job progress. Request presence of AHJ'S, perform tests, and document results using Contractor's Material and Test Certificates.

3.04 TESTING

- A. All tests shall be scheduled through and shall be witnessed by representatives of Twin Falls Fire Department)
- B. Hydrostatically test all system piping for two hours at 200 psi (or 50 psi higher than the maximum anticipated static pressure) with no loss in pressure and no visible leakage. Conduct the testing after all of the fire sprinkler heads and piping are installed. Have the tests witnessed by the AHJ's and Engineer. Submit a Contractor's Material and Test Certificate to the Architect upon successful completion of the testing.
- C. Perform all system operation tests for fire sprinkler system required by NFPA 13. Every water flow detector used on the project must be tested to ensure proper operation and retard settings.

- D. Train the Owner's maintenance personnel in the proper operation, testing and maintenance of all installed equipment.
- E. Conduct an inspection and operational test (main drain and inspector's test) at the end of the one-year guarantee period. The inspection and testing shall be in accordance with manufacturer's recommendations and NFPA 25. A written report is to be sent to the Owner upon completion of the inspection. Fire sprinkler installer shall conduct the tests.

3.05 CLEANING:

- A. Remove oil, scale, debris, and foreign substances from interior and exterior of devices, equipment, and materials prior to installation.
- B. Upon job completion, remove tools, surplus materials and equipment, leaving all areas broom clean.

3.06 ACCEPTANCE:

- A. Acceptance of installation is subject to final inspection and approval by:
 - 1. Twin Falls Fire Department
 - 2. Architect or his representative.

END OF SECTION 211313

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**SECTION 220513
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General construction and requirements.
- B. Applications.
- C. Single phase electric motors.
- D. Three phase electric motors.

1.02 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings 2015 (Reaffirmed 2020).
- B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators 2017.
- C. NEMA MG 1 - Motors and Generators 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

1.04 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Baldor Electric Company/ABB Group: www.baldor.com/#sle.
- B. Leeson Electric Corporation: www.leeson.com/#sle.

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Construction:
 - 1. Open drip-proof type except where specifically noted otherwise.
 - 2. Design for continuous operation in 104 degrees F environment.
 - 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

- C. Wiring Terminations:
 - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 - 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.03 APPLICATIONS

- A. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.

2.04 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than five times full load current.
- C. Pull-up Torque: Up to 350 percent of full load torque.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

- A. Starting Torque: Between 1 and 1-1/2 times full load torque.
- B. Starting Current: Six times full load current.
- C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
- D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.
- E. Insulation System: NEMA Class B or better.
- F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.
- G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- H. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- I. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.
- J. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 220513

**SECTION 220516
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Expansion joints and compensators.
- C. Pipe loops, offsets, and swing joints.

1.02 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.

1.03 REFERENCE STANDARDS

- A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.
- B. EJMA (STDS) - EJMA Standards Tenth Edition.
- C. FM (AG) - FM Approval Guide Current Edition.
- D. ITS (DIR) - Directory of Listed Products Current Edition.
- E. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
 - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with UL (DIR) requirements.

2.02 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

- A. Inner Hose: Stainless steel.
- B. Exterior Sleeve: Single braided, stainless steel.
- C. Pressure Rating: 125 psi up to 12 inch.
- D. Maximum Service Temperature: 450 degrees F.
- E. Size: Use pipe sized units.
- F. Maximum offset: 3/4 inch on each side of installed center line.

2.03 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Inner Hose: Bronze.
- B. Exterior Sleeve: Braided bronze.
- C. Pressure Rating: 125 psi up to 2 inch.
- D. Maximum Service Temperature: 450 degrees F.
- E. Size: Use pipe sized units.
- F. Maximum offset: 3/4 inch on each side of installed center line.
- G. Application: Copper piping.

2.04 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

- A. Pressure Rating: 125 psi and 400 degrees F.
- B. Maximum Compression: 1-3/4 inches.
- C. Maximum Extension: 1/4 inch.
- D. Joint Type: Externally pressurized with flanged ends.
- E. Size: Use pipe sized units.
- F. Application: Steel piping 4 inches and under.

2.05 EXPANSION JOINTS - EXTERNAL RING CONTROLLED STAINLESS STEEL BELLOWS TYPE

- A. Pressure Rating: 125 psi and 400 degrees F.
- B. Maximum Compression: 15/16 inch.
- C. Maximum Extension: 5/16 inch.
- D. Size: Use pipe sized units.
- E. Application: Steel piping over 2 inches.

2.06 EXPANSION JOINTS - SINGLE SPHERE, FLEXIBLE CONNECTOR

- A. Body Construction: Nylon-reinforced rubber tube.
- B. End Connections: Carbon steel flanges.
- C. Cover and Tube Elastomer: EPDM and EPDM.
- D. Maximum Elongation: 3/8 inch.
- E. Maximum Angular Movement: 15 degrees.

2.07 EXPANSION JOINTS - TWO-PLY BRONZE BELLOWS TYPE

- A. Construction: Bronze with anti-torque device, limit stops, internal guides.
- B. Pressure Rating: 125 psi and 400 degrees F.
- C. Maximum Compression: 1-3/4 inches.
- D. Maximum Extension: 1/4 inch.
- E. Joint: Soldered.
- F. Size: Use pipe sized units.
- G. Application: Copper piping.

2.08 EXPANSION JOINTS - COMPENSATORS

- A. Type: Two-ply 304 stainless steel bellows with carbon steel shroud.
- B. Maximum Working Pressure: 200 psi.
- C. Maximum Working Temperature: 400 degrees F.
- D. End Connections: Female copper sweat.
- E. Application: Copper piping up to 3 inches in size or steel piping up to 4 inches in size.

2.09 EXPANSION JOINTS - COPPER WITH PACKED SLIDING SLEEVE

- A. Working Pressure: 125 psi.
- B. Maximum Temperature: 250 degrees F.
- C. Size: Use pipe sized units.
- D. Application: Copper or steel piping 2 inches and over.

2.10 EXPANSION LOOPS - HOSE AND BRAID

- A. Provide flexible loops with two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return with support brackets and plugged drain port for steam service.

- B. Maximum Allowable Motion: 2 inch in the x, y, and z planes with no thrust loads to the building structure.
- C. Maximum Working Pressure: 150 psi at 800 degrees F.
- D. Construction: Class 150, schedule 40, stainless steel hose and braid assembly with carbon steel fittings, including elbows and flanged end connections sized to match pipe segment.
 - 1. Selected Product to Accommodate:
 - a. Angular Rotation: 15 degrees.
 - b. Force developed by 1.5 times specified maximum allowable operating pressure.
 - 2. Provide necessary accessories including, but not limited to, swivel joints.

2.11 EXPANSION JOINTS - EXTERNALLY PRESSURIZED

- A. Bellows Type: Two-ply, single bellows constructed of 304 stainless steel.
- B. Internal Liner: Carbon steel with internal and external guides.
- C. End Connections: Class 150, carbon steel, welded flange.
- D. Maximum Axial Compression: 4 inches.
- E. Maximum Working Pressure: 150 psi at 700 degrees F.
- F. Application: Steel piping 2 inches and over.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.
- C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION 220516

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**SECTION 220517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe sleeves.
- B. Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 099113 - Exterior Painting: Preparation and painting of exterior piping systems.
- C. Section 099123 - Interior Painting: Preparation and painting of interior piping systems.
- D. Section 220523 - General-Duty Valves for Plumbing Piping.
- E. Section 220553 - Identification for Plumbing Piping and Equipment: Piping identification.
- F. Section 220719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

- A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2022a.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- C. FM (AG) - FM Approval Guide Current Edition.
- D. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

- A. Vertical Piping:
 - 1. Sleeve Length: 1 inch above finished floor.
 - 2. Provide sealant for watertight joint.
 - 3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.

4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.
- B. Pipe Passing Through Below Grade Exterior Walls:
 1. Zinc coated or cast iron pipe.
 2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- C. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 2. Connect sleeve with floor plate except in mechanical rooms.
- D. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
 1. Galvanized steel pipe or black iron pipe with asphalt coating.
 2. Connect sleeve with floor plate except in mechanical rooms.
- E. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.
- F. Clearances:
 1. Provide allowance for insulated piping.
 2. Wall, Floor, Partitions, and Beam Flanges: 1 inch greater than external pipe diameter.
 3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

- A. Modular Mechanical Sleeve-Seal:
 1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
 2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
 3. Size and select seal component materials in accordance with service requirements.
 4. Glass-reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

- A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- B. Install piping to conserve building space, to not interfere with use of space and other work.
- C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- D. Inserts:
 1. Provide inserts for placement in concrete formwork.
 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- E. Structural Considerations: Do not penetrate building structural members unless indicated.
- F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
 2. Aboveground Piping:
 - a. Pack solid using mineral fiber complying with ASTM C592.
 - b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
 3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
 4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- G. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
 3. Locate piping in center of sleeve or penetration.
 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
 5. Tighten bolting for a water-tight seal.
 6. Install in accordance with manufacturer's recommendations.
- H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

- A. Upon completion of work, clean all parts of the installation.
- B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 220517

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**SECTION 220519
METERS AND GAUGES FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Liquid Meters:
 - 1. Disc meters.
 - 2. Compound meters.
 - 3. Turbine meters.
 - 4. Propeller meters.
- B. Flow meters.
- C. Pressure Gauges:
 - 1. Bourdon tube for liquids and gases.
- D. Thermometers.
- E. Pressure-Temperature test plugs.

1.02 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2022.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014 (Reapproved 2020).
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014 (Reapproved 2021).
- D. AWWA C700 - Cold-Water Meters -- Displacement Type, Metal Alloy Main Case 2020.
- E. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service 2019.
- F. AWWA C702 - Cold-Water Meters -- Compound Type 2019.
- G. AWWA C703 - Cold-Water Meters -- Fire-Service Type 2019.
- H. AWWA M6 - Water Meters -- Selection, Installation, Testing, and Maintenance 2012, with Addendum (2018).

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Utility Service Metering: Coordinate and apply Utility Service Provider requirements in terms of meter type, size, physical location, pipe size, upstream/downstream pipe lengths required, and other installation details.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide red-marked product data sheets for each furnished item with associated components and accessories.
- C. Project Record Documents: Record actual locations of components and instrumentation.

PART 2 PRODUCTS

2.01 LIQUID METERS

- A. Disc Meters:
 - 1. Manufacturers:
 - a. Badger Meter, Inc: www.badgermeter.com/#sle.
 - b. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
 - c. Mueller Systems, Llc: muellersystems.com/#sle.
 - d. Niagara Meters: www.niagarameters.com/#sle.

2. Utility Connection Size: 5/8 inch NPT female.
 3. Lead-free bronze alloy case and cap with hermetically-sealed mechanical register.
- B. Compound Meters:
1. Manufacturers:
 - a. Badger Meter, Inc: www.badgermeter.com/#sle.
 - b. Mueller Systems, Llc: muellersystems.com/#sle.
 - c. Sensus, a Xylem brand: www.sensus.com/#sle.
 - d. Zenner USA: www.zennerusa.com/#sle.
 2. Utility Connection Size: 3 inch flanged.
 3. Lead-free bronze alloy case, polymer-based cap, and hermetically sealed register.
- C. Turbine Meters:
1. Manufacturers:
 - a. Badger Meter, Inc: www.badgermeter.com/#sle.
 - b. Mueller Systems, Llc: muellersystems.com/#sle.
 - c. Niagara Meters: <https://www.niagarameters.com/#sle>.
 - d. Sensus, a Xylem brand: www.sensus.com/#sle.
 - e. Zenner USA: www.zennerusa.com/#sle.
 2. Utility Connection Size: 12 inch flanged with upstream strainer.
 3. Coated ductile iron case, polymer-based cap, test port, and hermetically sealed register with low flow indicator.
- D. Propeller Meters:
1. Manufacturers:
 - a. Sensus, a Xylem brand: www.sensus.com/#sle.
 2. Utility Connection Size: 24 inch flanged with upstream strainer.
 3. Cast bronze case, polymer-based cap, and hermetically sealed register.

2.02 PRESSURE GAUGES

- A. Bourdon Tube for Liquids and Gases:
1. Dial Size and Cover: 4-1/2 inch diameter scale with polycarbonate window.
 2. Accuracy: ASME B40.100, adjustable industrial grade (A) with 1 percent at mid-range of span.
 3. Process Connection: Lower-back, 1/4 inch NPT male except where noted.
- B. Accessories:
1. Gauge Cock: Brass with tee or lever handle for maximum 150 psi.
 2. Needle Valve: Brass, 1/4 inch NPT female for noncorrosive service.
 3. Pressure Snubber (Pulsation Damper): Brass, 1/4 inch NPT male.

2.03 THERMOMETERS

- A. General:
1. Product Compliance: ASTM E1.
 2. Lens: Clear glass, except where stated.
 3. Accuracy: One percent, when tested in accordance with ASTM E77, except where stated.
 4. Scale: Black markings depicting single scale in degrees F where expected process value falls half-span of standard temperature range.
- B. Thermometers - Dial Type:
1. Fixed: 5 inch diameter dial with black pointer, stainless steel case, silicone damping bimetal element, hermetically sealed lens, recalibrating screw, and 2-1/2 inch NPT stem.
 2. Adjustable Angle: 5 inch diameter dial with black pointer, stainless steel case, silicone damping bimetal element, hermetically sealed lens, recalibrating screw, and 2-1/2 inch NPT stem.

3. Vapor (Gas) Actuated: 4-1/2 inch glass-reinforced phenolic case, aluminum dial with black pointer, recalibrating screw, 2 inch brass thermowell, adjustable joint with positive locking device allowing 180 degrees in vertical plane adjustment and capillary.

2.04 PRESSURE-TEMPERATURE TEST PLUGS:

- A. Size: 500 psi capacity; 1/4 inch MPT brass fitting with gasket, cap, and retaining strap for 1/8 inch pressure gauge or temperature probe.
- B. Wetted Materials per Temperature Range:
 1. Up to 200 degrees F: Brass probe with neoprene core.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.
- B. Install water meters with inlet and outlet isolation valves in compliance with AWWA M6.
- C. Install thermometers as follows:
 1. Hot Water Heaters: Place upstream and downstream of heater. Add one on the inlet end when using steam as the water heating medium.
 2. As indicated on drawings.
 3. Piping: Install thermometers in branch butt weld connection fitting or socket-weld thermowell. Enlarge pipes smaller than 2-1/2 inch to accommodate sockets. Ensure sockets are above insulation clearance.
- D. Locate PT (pressure-temperature) test plugs adjacent to control device sockets.

END OF SECTION 220519

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**SECTION 220523
GENERAL-DUTY VALVES FOR PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Ball valves.
- B. Butterfly valves.
- C. Check valves.

1.02 RELATED REQUIREMENTS

- A. Section 220553 - Identification for Plumbing Piping and Equipment.
- B. Section 220719 - Plumbing Piping Insulation.
- C. Section 221005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. TFE: Tetrafluoroethylene.
- I. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

- A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding 2022.
- B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2020.
- D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.
- E. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2022.
- F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- G. ASME B16.34 - Valves — Flanged, Threaded, and Welding End 2020.
- H. ASME B31.9 - Building Services Piping 2020.
- I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.
- J. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).
- K. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.
- L. MSS SP-45 - Drain and Bypass Connections 2020.
- M. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends 2018.
- N. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- O. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.

- P. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- Q. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided 2018.
- R. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- S. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.06 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Obtain valves for each valve type from single manufacturer.
 - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
 - 2. Protect valve parts exposed to piped medium against rust and corrosion.
 - 3. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
 - 4. Secure check valves in either the closed position or open position.
 - 5. Adjust butterfly valves to closed or partially closed position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection and protect flanges and specialties from dirt.
 - a. Provide temporary inlet and outlet caps.
 - b. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

- A. See drawings for specific valve locations.
- B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).
- C. Provide the following valves for the applications if not indicated on drawings:
 - 1. Shutoff: Ball, butterfly, gate or plug.
 - 2. Swing Check (Pump Outlet):
 - a. 2 inch and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
 - b. 2-1/2 inch and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
- D. Required Valve End Connections for Non-Wafer Types:
 - 1. Steel Pipe:
 - a. 2 inch and Smaller: Threaded ends.
- E. Domestic, Hot and Cold Water Valves:
 - 1. 2 inch and Smaller:
 - a. Bronze and Brass: Provide with solder-joint ends.
 - b. Ball: One piece, full port, brass with brass trim.
 - c. Bronze Swing Check: Class 125, bronze disc.
 - 2. 2-1/2 inch and Larger:
 - a. Iron, 2-1/2 inch to 4 inch: Provide with threaded ends.
 - b. Iron Ball: Class 150.

- c. Iron Swing Check: Class 125, metal seats.

2.02 GENERAL REQUIREMENTS

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
 - 1. Hand Lever: Quarter-turn valves 6 inch and smaller except plug valves.
- D. Insulated Piping Valves: With 2 inch stem extensions and the following features:
 - 1. Gate Valves: Rising stem.
 - 2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: Extended neck.
 - 4. Memory Stops: Fully adjustable after insulation is installed.
- E. Valve-End Connections:
 - 1. Threaded End Valves: ASME B1.20.1.
 - 2. Solder Joint Connections: ASME B16.18.
- F. General ASME Compliance:
 - 1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
 - 2. Solder-joint Connections: ASME B16.18.
 - 3. Building Services Piping Valves: ASME B31.9.
- G. Potable Water Use:
 - 1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
 - 2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

2.03 BRASS, BALL VALVES

- A. Two Piece, Full Port with Brass Trim and Female Thread, Male thread, or Solder Connections:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi.
 - 3. CWP or WOG Rating: 600 psi.
 - 4. Body: Forged brass.
 - 5. Seats: PTFE.
 - 6. Stem: Brass.
 - 7. Ball: Chrome-plated brass.
 - 8. Operator: Lockable handle and memory stop.

2.04 BRONZE, BALL VALVES

- A. General:
 - 1. Fabricate from dezincification resistant material.
 - 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. One Piece, Reduced Port with Bronze Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 400 psi.
 - 3. CWP Rating: 600 psi.
 - 4. Body: Bronze.
 - 5. End Connections: Pipe press.
 - 6. Seats: PTFE.
- C. Two Piece, Full Port with Bronze Trim:
 - 1. Comply with MSS SP-110.
 - 2. WSP Rating: 150 psi.

3. WOG Rating: 600 psi.
4. Body: Forged bronze or dezincified-brass alloy.
5. Ends Connections: Pipe thread or solder.
6. Seats: PTFE.
7. Stem: Bronze, blowout proof.
8. Ball: Chrome plated brass.

2.05 IRON, BALL VALVES

- A. Class 125, Full Port, Stainless Steel Trim:
 1. Comply with MSS SP-72.
 2. CWP Rating: 200 psi.
 3. Body: ASTM A536 Grade 65-45-12, ductile iron.
 4. End Connections: Flanged.
 5. Seats: PTFE.
 6. Stem: Stainless steel.
 7. Ball: Stainless steel.
 8. Operator: Lever with locking handle.

2.06 BRONZE, SWING CHECK VALVES

- A. General:
 1. Fabricate from dezincification resistant material.
 2. Copper alloys containing more than 15 percent zinc are not permitted.
- B. Class 125:
 1. Pressure and Temperature Rating: MSS SP-80, Type 3.
 2. Design: Y-pattern, horizontal or vertical flow.
 3. CWP or WOG Rating: 200 psi.
 4. Body: Bronze, ASTM B62.
 5. End Connections: Threaded.
 6. Disc: Bronze.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Install check valves where necessary to maintain direction of flow as follows:
 1. Lift Check: Install with stem plumb and vertical.
 2. Swing Check: Install horizontal maintaining hinge pin level.
 3. Orient plate-type into horizontal or vertical position, between flanges.

END OF SECTION 220523

**SECTION 220529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2022.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
 - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
 - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

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

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.06 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Metal Channel (Strut) Framing Systems:
 - 1. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 2. Comply with MFMA-4.
 - 3. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 - 4. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
 - 5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
- C. Hanger Rods:
 - 1. Threaded zinc-plated steel unless otherwise indicated.
 - 2. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch diameter.
 - b. Piping up to 1 inch: 1/4 inch diameter.
 - c. Piping larger than 1 inch: 3/8 inch diameter.
 - d. Trapeze Support for Multiple Pipes: 3/8 inch in length.
- D. Thermal Insulated Pipe Supports:
 - 1. General Requirements:
 - a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
 - b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
 - c. Pipe supports to be provided for nominally sized 1/2 to 30 inch iron pipes.

- d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
 2. PVC Jacket:
 - a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
 - b. Minimum Service Temperature: Minus 40 degrees F.
 - c. Maximum Service Temperature: 180 degrees F.
 - d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
 - e. Thickness: 60 mil.
 - f. Connections: Brush on welding adhesive.
 3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.
- E. Pipe Supports:
1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
 2. Liquid Temperatures Up To 122 degrees F:
 - a. Overhead Support: MSS SP-58 Types 1, 3 through 12 clamps.
 - b. Support From Below: MSS SP-58 Types 35 through 38.
 3. Operating Temperatures from 122 to 446 degrees F:
 - a. Overhead Support: MSS SP-58 Type 1 or 3 through 12 clamps with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
 - b. Roller Chair: MSS SP-58 Types 41 or 43 through 46 roller chair support with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
 - c. Sliding Support: MSS SP-58 Types 35 through 38.
- F. Beam Clamps:
1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
 2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with plain, stainless steel, and zinc finish.
 3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish. For inverted usage provide manufacturer listed size(s).
 4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.
 5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.
 6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, plain finish.
 7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
 8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
- G. Riser Clamps:
1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
 2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, plain, stainless steel, or zinc plated finish.
 3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, plain, stainless steel, or zinc plated finish.
 4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.
 5. UL (DIR) listed: Pipe sizes 1/2 to 8 inch.
- H. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
- I. Strut Clamps:
1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.

- J. Pipe Hangers:
 - 1. Hangers:
 - a. Provide hinged split ring and yoke roller hanger with epoxy copper or plain finish.
 - b. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
 - c. Provide hanger rod and nuts of the same type and material for a given pipe run.
 - d. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
 - 2. Clevis Hangers, Adjustable:
 - a. Copper Tube: MSS SP-58 Type 1, epoxy-plated copper.
 - b. Light-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
 - c. Standard-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
- K. Intermediate Pipe Guides:
 - 1. Pipe Sizes 6 inch and Smaller: Minimum clearance of 0.16 inch.
 - 2. Pipe Size 8 inch: 0.625 inch U-bolt with double nuts providing minimum clearance of 0.28 inch.
- L. Pipe Alignment Guides: Galvanized steel.
 - 1. Pipe Size 8 inch and Smaller: Spider or sleeve type.
- M. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.
- N. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
 - 1. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
 - 2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
- O. Pipe Shields for Insulated Piping:
 - 1. General Construction and Requirements:
 - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
 - b. Shields Material: UV-resistant polypropylene with glass fill.
 - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
 - d. Minimum Service Temperature: Minus 40 degrees F.
 - e. Maximum Service Temperature: 178 degrees F.
 - f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
- P. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 - 4. Hollow Masonry: Use toggle bolts.
 - 5. Hollow Stud Walls: Use toggle bolts.
 - 6. Steel: Use beam ceiling clamps, beam clamps, machine bolts, or welded threaded studs.
 - 7. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, plain, stainless steel, or zinc finish.
 - 8. Sheet Metal: Use sheet metal screws.
 - 9. Wood: Use wood screws.
 - 10. Plastic and lead anchors are not permitted.
 - 11. Powder-actuated fasteners are not permitted.
 - 12. Hammer-driven anchors and fasteners are not permitted.

13. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Comply with MFMA-4.
 - b. Channel Material: Use galvanized steel.
 - c. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
 - d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Field-Welding (where approved by Architect): Comply with Section 055000.
- H. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
- I. Equipment Support and Attachment:
 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- J. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.
- K. Secure fasteners according to manufacturer's recommended torque settings.
- L. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.

- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 220529

SECTION 220548
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Seismic control requirements.
- C. Vibration-isolated equipment support bases.
- D. Vibration isolators.
- E. Seismic restraint systems.

1.02 RELATED REQUIREMENTS

- A. Section 014533 - Code-Required Special Inspections and Procedures.
- B. Section 033000 - Cast-in-Place Concrete.

1.03 DEFINITIONS

- A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).
- B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.
- C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.
- D. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.
- E. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.
- F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.
- G. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. MFMA-4 - Metal Framing Standards Publication 2004.
- I. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
 - 2. Seismic Controls: Include seismic load capacities.
- D. Shop Drawings - Vibration Isolation Systems:
 - 1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

1.06 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Seismic Controls Designer Qualifications: Registered professional engineer licensed in Idaho and with minimum five years experience designing seismic restraints for nonstructural components.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 1. Select vibration isolators to provide required static deflection.
 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
- D. Equipment Isolation: As indicated on drawings.
- E. Piping Isolation:
 1. Provide vibration isolators for piping supports:
 - a. Located in equipment rooms.
 - b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
 - c. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.

2.02 SEISMIC CONTROL REQUIREMENTS

- A. Design and provide plumbing component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor plumbing components.
- B. Seismic Design Criteria: As indicated on drawings.
- C. Component Importance Factor (I_p): Plumbing components to be assigned a component importance factor (I_p) of 1.5 unless otherwise indicated.
- D. Seismic Restraints:
 1. Provide seismic restraints for plumbing components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
 2. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
 - a. FEMA 412.
 - b. FEMA 413.
 - c. FEMA 414.
 - d. FEMA E-74.
 - e. SMACNA (SRM).
 3. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
 4. Seismic Restraint Systems:

- a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
 - b. Use only cable restraints to restrain vibration-isolated plumbing components, including distributed systems.
 - c. Use only one restraint system type for a given plumbing component or distributed system (e.g., piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
 - d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain plumbing component in all lateral directions; consider bracket geometry in anchor load calculations.
 - e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported plumbing component weight.
 - f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported plumbing component weight.
 - g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
 - h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
 - i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
- E. Seismic Attachments:
1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
 2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
 3. Do not use power-actuated fasteners.
 4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
 5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
 6. Concrete Housekeeping Pads:
 - a. Increase size of pad as required to comply with anchor requirements.
 - b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.
- F. Seismic Interactions:
1. Include provisions to prevent seismic impact between plumbing components and other structural or nonstructural components.
 2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
- G. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:
 - a. Relative displacements at connections between components, including distributed systems (e.g., piping); do not exceed load limits for equipment utility connections.
 - b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
 - c. Design displacements at seismic separations.

- d. Anticipated drifts between floors.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

- A. Vibration-Isolated Structural Steel Bases:
 - 1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
- B. Vibration-Isolated Concrete Inertia Bases:
 - 1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
 - 2. Minimum Base Depth: 6 inches.
 - 3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
 - 4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
 - 5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 033000.

2.04 VIBRATION ISOLATORS

- A. General Requirements:
 - 1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
 - 2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.

2.05 SEISMIC RESTRAINT SYSTEMS

- A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.
- B. Cable Restraints:
 - 1. Comply with ASCE 19.
 - 2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
 - 3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
 - 4. Use protective thimbles for cable loops where potential for cable damage exists.
- C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

- A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 014533 and statement of special inspections as required by applicable building code.

- B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
 - 1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
 - 2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.
- C. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.
- D. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- C. Secure fasteners according to manufacturer's recommended torque settings.
- D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- E. Vibration Isolation Systems:
 - 1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 - 2. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 - 3. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 - 4. Adjust isolators to be free of isolation short circuits during normal operation.
 - 5. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.
- F. Seismic Controls:
 - 1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
 - 2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
 - 3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
 - 4. Equipment with Sheet Metal Housings:
 - a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
 - b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
 - c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
 - 5. Concrete Housekeeping Pads:
 - a. Size in accordance with seismic design to meet anchor requirements.
 - b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
 - 6. Seismic Restraint Systems:
 - a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.

- b. Install restraints within permissible angles in accordance with seismic design.
- c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
- d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
- e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect vibration isolation and/or seismic control components for damage and defects.
- C. Vibration Isolation Systems:
 - 1. Verify isolator static deflections.
 - 2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
- D. Seismic Controls:
 - 1. Verify snubbing element air gaps.
- E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 220548

**SECTION 220553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

1.02 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Schedules:
 - 1. Submit plumbing component identification schedule listing equipment, piping, and valves.
 - 2. Detail proposed component identification data in terms of wording, symbols, letter size, and color coding to be applied to corresponding product.
 - 3. Valve Data Format: Include id-number, location, function, and model number.
- C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

- A. Nameplates:
 - 1. Heat exchangers, water heaters, and other heat transfer products.
 - 2. Control panels, transducers, and other related control equipment products.
 - 3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.
- B. Tags:
 - 1. Piping: 3/4 inch diameter and smaller.
 - 2. Ceiling tacks placed on lay-in ceiling surface to reference plumbing components.
- C. Pipe Markers: 3/4 inch diameter and higher.

2.02 NAMEPLATES

- A. Description: Laminated piece with up to three lines of text.
 - 1. Letter Color: White.
 - 2. Letter Height: 1/4 inch.
 - 3. Background Color: Black.

2.03 TAGS

- A. Flexible: Vinyl with engraved black letters on light contrasting background color with up to three lines of text. Minimum tag size 1-1/2 inch in diameter.
- B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.
- C. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Comply with ASME A13.1.

- B. Flexible Tape Marker: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
- C. Identification Scheme, ASME A13.1:
 - 1. Primary: External Pipe Diameter, Uninsulated or Insulated.
 - a. 3/4 to 1-1/4 inches: Use 8 inch field-length with 1/2 inch text height.
 - b. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
 - c. 2-1/2 to 6 inches: Use 12 inch field-length with 1-1/4 inch text height.
 - 2. Secondary: Color scheme per fluid service.
 - a. Combustible Fluids: White text on brown background.
 - b. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

2.05 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.
- B. Color code as follows:
 - 1. Plumbing Equipment: Yellow.
 - 2. Plumbing Valves: Green.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

- A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags in clear view and align with axis of piping
- C. Install plastic tape pipe marker around pipe in accordance with manufacturer's instructions.
- D. Apply ASME A13.1 Pipe Marking Rules:
 - 1. Place pipe marker adjacent to changes in direction.
 - 2. Place pipe marker adjacent each valve port and flange end.
 - 3. Place pipe marker at both sides of floor and wall penetrations.
 - 4. Place pipe marker every 25 to 50 feet interval of straight run.
- E. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 220553

**SECTION 220719
PLUMBING PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cellular glass insulation.
- B. Flexible elastomeric cellular insulation.
- C. Glass fiber insulation.
- D. Polyethylene insulation.
- E. Polyisocyanurate cellular plastic insulation.
- F. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).
- B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.
- C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2022.
- D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- E. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber 2020.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER INSULATION

- A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- B. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm inch.

2.03 CELLULAR GLASS INSULATION

- A. Insulation: ASTM C552, Type II, Grade 6.
 - 1. K Value: 0.35 at 100 degrees F.
 - 2. Service Temperature Range: From 250 degrees F to 800 degrees F.
 - 3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
 - 4. Water Absorption: 0.5 percent by volume, maximum.

2.04 POLYETHYLENE INSULATION

- A. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
 - 1. K Value: ASTM C177; 0.25 at 75 degrees F.
 - 2. Maximum Service Temperature: 200 degrees F.
 - 3. Density: 2 pcf.
 - 4. Maximum Moisture Absorption: 1.0 percent by volume.
 - 5. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.
 - 6. Connection: Contact adhesive.

2.05 JACKETING AND ACCESSORIES

- A. PVC Plastic.
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil, 0.010 inch.
 - e. Connections: Brush on welding adhesive.
- B. Aluminum Jacket:
 - 1. Thickness: 0.016 inch sheet.
 - 2. Finish: Smooth.
 - 3. Joining: Longitudinal slip joints and 2 inch laps.
 - 4. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass fiber insulated pipes conveying fluids below ambient temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- G. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert Location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
- H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.
- I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
- J. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

END OF SECTION 220719

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**SECTION 221005
PLUMBING PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary waste piping, buried within 5 feet of building.
- B. Sanitary waste piping, above grade.
- C. Domestic water piping, buried within 5 feet of building.
- D. Domestic water piping, above grade.
- E. Storm drainage piping, buried within 5 feet of building.
- F. Storm drainage piping, above grade.
- G. Natural gas piping, buried within 5 feet of building.
- H. Natural gas piping, above grade.
- I. Pipe flanges, unions, and couplings.
- J. Pipe hangers and supports.
- K. Ball valves.
- L. Flow-balancing valves.
- M. Pressure relief valves.
- N. Pressure-temperature valves.
- O. Strainers.

1.02 RELATED REQUIREMENTS

- A. Section 083100 - Access Doors and Panels.
- B. Section 099113 - Exterior Painting.
- C. Section 099123 - Interior Painting.
- D. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.
- E. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.
- F. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- G. Section 220553 - Identification for Plumbing Piping and Equipment.
- H. Section 220719 - Plumbing Piping Insulation.
- I. Section 312316 - Excavation.
- J. Section 312323 - Fill.

1.03 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).
- B. ANSI Z223.1 - National Fuel Gas Code 2021.
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2020.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
- E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2021.
- F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
- G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- H. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV 2021.
- I. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.

- J. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV 2017.
- K. ASME B31.1 - Power Piping 2022.
- L. ASME B31.9 - Building Services Piping 2020.
- M. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2023.
- N. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2023.
- O. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Potable Water Distribution Systems 2020.
- P. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).
- Q. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- R. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- S. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2023.
- T. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.
- U. ASTM B32 - Standard Specification for Solder Metal 2020.
- V. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.
- W. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes 2020.
- X. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed 2019.
- Y. ASTM B75/B75M - Standard Specification for Seamless Copper Tube 2020.
- Z. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.
- AA. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.
- BB. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.
- CC. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes 2017.
- DD. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV) 2020.
- EE. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- FF. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- GG. ASTM C4 - Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile 2004 (Reapproved 2018).
- HH. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe 2020.
- II. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric). 2020.
- JJ. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe 2022a.

- KK. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric) 2022a.
- LL. ASTM C425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings 2022.
- MM. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets 2021.
- NN. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric) 2021.
- OO. ASTM C700 - Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated 2018 (Reapproved 2022).
- PP. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications 2000 (Reapproved 2015).
- QQ. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120 2021a.
- RR. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter 2022.
- SS. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2020.
- TT. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40 2021.
- UU. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.
- VV. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe 2021.
- WW. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.
- XX. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.
- YY. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.
- ZZ. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing 2023.
- AAA. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.
- BBB. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).
- CCC. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.
- DDD. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- EEE. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .
- FFF. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- GGG. NSF 372 - Drinking Water System Components - Lead Content 2022.
- HHH. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe 2021.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D2665. Schedule 40.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

- A. Copper Tube (condensate piping): ASTM B306, DWV.
 - 1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, solvent.
 - 2. Joints: ASTM B32, alloy Sn50 solder.
- B. PVC Pipe: ASTM D2665. Schedule 40.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Pipe: ASTM B42, hard drawn. Type K.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.
- B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
 - 1. PPI TR-4 Pressure Design Basis:
 - a. 100 psig at maximum 180 degrees F.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, alloy Sn95 solder.

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. PVC Pipe: ASTM D2665, schedule 40.
 - 1. Fittings: PVC.
 - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.08 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: ASME B31.1, welded.
 - 3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.09 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
 - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
 - 2. Joints: Threaded or welded to ASME B31.1.

2.10 PIPE FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 inch and Under:
 - 1. Ferrous Pipe: Class 150 malleable iron threaded unions.
 - 2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

2.11 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
 - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
 - 4. Vertical Pipe Support: Steel riser clamp.
 - 5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
 - 6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
 - a. Bases: High-density polypropylene.
 - b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - c. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 - d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.
 - e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
- B. Plumbing Piping - Drain, Waste, and Vent:
 - 1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 - 2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 - 3. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.
 - 4. Wall Support for Pipe Sizes 4 inch and Over: Welded steel bracket and wrought steel clamp.
- C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
 2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
 3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
 2. Other Types: As required.

2.12 BALL VALVES

- A. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.13 FLOW-BALANCING VALVES

- A. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.14 PRESSURE RELIEF VALVES

- A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

2.15 PRESSURE-TEMPERATURE VALVES

- A. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

2.16 STRAINERS

- A. Size 2 inch and Smaller:
1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 1-1/2 inch to 4 inch:
1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.

- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 220516.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
 - 1. See Section 220719.
- H. Provide access where valves and fittings are not exposed.
 - 1. Coordinate size and location of access doors with Section 083100.
- I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly; refer to Architectural Specifications Sections.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.
- K. Provide support for utility meters in accordance with requirements of utility companies.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
 - 1. See Section 099123 for painting of interior plumbing systems and components.
 - 2. See Section 099113 for painting of exterior plumbing systems and components.
- M. Excavate in accordance with Section 312316.
- N. Backfill in accordance with Section 312323.
- O. Install valves with stems upright or horizontal, not inverted. See Section 220523.
- P. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- Q. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- R. Sleeve pipes passing through partitions, walls, and floors.
- S. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- T. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as indicated.
 - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
 - 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
 - 10. Support cast iron drainage piping at every joint.

3.04 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Provide spring-loaded check valves on discharge of water pumps.
- D. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system.
- B. Prior to starting work, verify system is complete, flushed, and clean.
- C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- D. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.
- E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- F. Maintain disinfectant in system for 24 hours.
- G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.
 - 1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

END OF SECTION 221005

**SECTION 221006
PLUMBING PIPING SPECIALTIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Refrigerator valve and recessed box.
- E. Backflow preventers.
- F. Double check valve assemblies.
- G. Water hammer arrestors.
- H. Mixing valves.
- I. Relief valves.
- J. Air vents.
- K. Electronic trap-seal primers.

1.02 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.
- B. Section 223000 - Plumbing Equipment.
- C. Section 224000 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

- A. ASME A112.6.3 - Floor and Trench Drains 2019.
- B. ASME A112.6.4 - Roof, Deck, and Balcony Drains 2022.
- C. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers 2017.
- D. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent 2021.
- E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies 2021.
- F. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies 2021.
- G. ASSE 1048 - Performance Requirements for Double Check Detector Backflow Prevention Assemblies 2021.
- H. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- I. NSF 372 - Drinking Water System Components - Lead Content 2022.
- J. PDI-WH 201 - Water Hammer Arresters 2017.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

- F. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - 2. Josam Company: www.josam.com/#sle.
 - 3. Zurn Industries, LLC: www.zurn.com/#sle.
- B. Roof Drains:
 - 1. Assembly: ASME A112.6.4.
 - 2. Body: Lacquered cast iron with sump.
 - 3. Strainer: Removable cast iron dome.
- C. Roof Overflow Drains:
 - 1. Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended to 2 inches above flood elevation.
- D. Downspout Nozzles:
 - 1. Bronze round with straight bottom section.
- E. Floor Drain:
 - 1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
- F. Floor Sink:
 - 1. Lacquered cast iron body with dome strainer and seepage flange.

2.03 CLEANOUTS

- A. Manufacturers:
 - 1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 - 2. Josam Company: www.josam.com/#sle.
 - 3. MIFAB, Inc: www.mifab.com/#sle.
 - 4. Zurn Industries, LLC: www.zurn.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Cleanouts at Exterior Surfaced Areas (CO-1):
 - 1. Round cast nickel bronze access frame and non-skid cover.
- C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
 - 1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.
- D. Cleanouts at Interior Finished Floor Areas (CO-3):
 - 1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.
- E. Cleanouts at Interior Finished Wall Areas (CO-4):

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.
- F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HOSE BIBBS

- A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 2. Watts Regulator Company: www.wattsregulator.com/#sle.
 3. Zurn Industries, LLC: www.zurn.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Interior Hose Bibbs:
1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome-plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

2.05 REFRIGERATOR VALVE AND RECESSED BOX

- A. Box Manufacturers:
1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
 2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Valve Manufacturers:
1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
 2. Viega LLC: www.viega.us/#sle.
 3. Substitutions: See Section 016000 - Product Requirements.
- C. Description: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.06 BACKFLOW PREVENTERS

- A. Manufacturers:
1. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
 2. Zurn Industries, LLC; 375XL: www.zurn.com/#sle.
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Reduced Pressure Backflow Preventer Assembly:
1. ASSE 1013; cast bronze body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.
 2. Size: 3/4 to 2 inch assembly with threaded gate valves.
- C. Reduced Pressure Backflow Preventer Assembly:
1. ASSE 1013 and NSF 61 compliant stainless steel body assembly with corrosion resistant internal parts, stainless steel springs, diaphragm type differential pressure relief valve located between check valves, third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.
 2. Configured to protect against backsiphonage and backpressure into potable water supply.
 3. Size: 2-1/2 to 10 inch assembly with flanged OS&Y gate valves.

2.07 DOUBLE CHECK-VALVE ASSEMBLIES

- A. Manufacturers:
1. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
 2. Zurn Industries, LLC; 350AST: www.zurn.com/#sle.

3. Substitutions: See Section 016000 - Product Requirements.
- B. Double Check Valve Assembly:
 1. ASSE 1012; cast bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
 2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.
- C. Double Check Valve Assembly:
 1. ASSE 1015 and NSF 61 compliant stainless steel body assembly with corrosion resistant internal parts, stainless steel springs, intermediate atmospheric vent, two independently-operating check valves, and test-cock plug for horizontal or vertical mount.
 2. Configured to protect against backsiphonage and backpressure into potable water supply.
 3. Size: 2-1/2 to 10 inch assembly with flanged OS&Y gate valves.

2.08 WATER HAMMER ARRESTORS

- A. Manufacturers:
 1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
 2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
 3. Zurn Industries, LLC: www.zurn.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Water Hammer Arrestors:
 1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.09 MIXING VALVES

- A. Thermostatic Mixing Valves:
 1. Valve: Chrome-plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
 2. Accessories:
 - a. Check valve on inlets.
- B. Pressure Balanced Mixing Valves:
 1. Valve: Chrome-plated cast brass body, stainless steel cylinder, integral temperature adjustment.

2.10 RELIEF VALVES

- A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.11 AIR VENTS

- A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- B. Float Type:
 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
 2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

2.12 FLOOR DRAIN TRAP SEALS

- A. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

2.13 ELECTRONIC TRAP-SEAL PRIMERS

- A. Description: Enclosed electronic trap seal primer system with timer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- F. Pipe relief from backflow preventer to nearest drain.
- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks, washing machine outlets, or FLUSH VALVES.

END OF SECTION 221006

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**SECTION 221343
FACILITY PACKAGED SEWAGE PUMPING STATIONS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged wastewater pumping stations.
- B. Pumps.
- C. Valves.
- D. Piping.
- E. Pump and level control panel.
- F. Instrumentation and controls.

1.02 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.
- B. Section 312323 - Fill: Backfilling.

1.03 REFERENCE STANDARDS

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's technical literature for prefabricated assemblies and pump chamber and access way; include installation instructions.
 - 1. Control and power instrumentation and panels.
 - 2. Pump curves.
 - 3. Motor data.
 - 4. Specimen warranty.
 - 5. Provide the following motor/pumps design information prior to final turnover - number of motor rotor bars and stator slots; number of cooling fan blades; RPM of motor; bearings, bearing manufacturer, bearing type, bearing style and number of balls/elements; number of commutator bars and commutator brushes; SCR firing frequencies; and number of pump impellers.
- C. Shop Drawings: Detailed drawings of entire pumping station, combining components furnished by different manufacturers, if any.
 - 1. Control panel schematic diagrams.
 - 2. Show the design of the chamber, with dimensions, types, and thicknesses of materials, and elevation levels with reference to those elevations indicated.
- D. Operating and Maintenance Data:
 - 1. Submit preventative maintenance and inspection procedure for package lift stations.
 - 2. Include in procedures the frequency of preventative maintenance, inspection, adjustment, lubrication, and cleaning necessary to minimize corrective maintenance and repair.
 - 3. Submit spare parts data, including a complete list of parts and supplies with current unit prices and source of supply.
 - 4. List parts and supplies that are either normally furnished at no extra cost with the purchase of equipment, or specified to be furnished as a part of the contract, and list additional items recommended by the manufacturer to ensure an efficient operation for a period of one year.
- E. Maintenance Materials:
 - 1. One set of special tools that are required for maintenance and testing.
- F. Executed Warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. See Section 016000 - Product Requirements for additional requirements.

1.06 WARRANTY

- A. Warranty: Provide manufacturer's warranty for packaged pump station, with itemized list of components covered by warranty; include list of specific operation and maintenance procedures that are required to keep warranty valid.

PART 2 PRODUCTS

2.01 PACKAGED WASTEWATER PUMPING STATIONS

- A. Manufacturers:
 - 1. Weil.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Packaged Wastewater Pumping Stations: Pre-engineered duplex sewage pump station, including wet well/pump chamber construction, access way(s), valves, internal piping, internal wiring, controls, and other necessary components for continuous, unattended, automatic operation.
 - 1. Furnish all components factory-assembled to greatest extent possible; where field installation is required, provide piping, wiring, and other components as required for a complete installation.
 - 2. Service Life: 15 years.
 - 3. Pumping Capacity: See schedule.
 - 4. Total Head: See schedule.
 - 5. Finish all components in accordance with manufacturer's standard practice for sewage resistance.
- C. Pump Lifting Assembly: Factory-assembled, mounted in wet well, designed to allow each pump to be independently raised to ground level for maintenance and returned to position without entering wet well; vertical rails, pump support assembly sliding on rails, integral guide bracket on pump, pump quick disconnect with hydraulic sealing flange, discharge pipe supports, and lifting chain; all metal parts stainless steel or bronze.
- D. Anchors and Fasteners: Stainless steel.
- E. Identification: For each item of equipment, provide the manufacturer's name or trademark and model number on corrosion-resistant identification plate, cast integrally, stamped, or otherwise permanently marked in conspicuous place; for pumps, include pump capacity in gpm and Lpm, pump head in feet and meters, speed of rotation, and direction of rotation.

2.02 PUMPS

- A. Manufacturers:
 - 1. Substitutions: See Section 016000 - Product Requirements.
- B. Sewage Solids-Handling Pumps: Non-clogging submersible centrifugal pump designed to pump unscreened sewage and capable of passing 3 inch solids.
- C. Pump Construction:
 - 1. Body: Cast iron, designed to permit easy replacement of parts; internal passageways permitting smooth flow of sewage and free from sharp turns and projections; cleanout plates in suction line and drain plugs; all joints gasketed.
 - 2. Impellers: Cast iron; free flowing, with necessary clearance to permit objects in sewage to pass; keyed, splined, or threaded onto shaft and locked in such manner that lateral movement is prevented and reverse rotation cannot cause loosening.
 - 3. Shafts: Stainless steel, of size and strength required.
 - 4. Shaft Sleeves: Protect shaft from liquid being pumped, points in contact with stuffing boxes, and other wearing parts with sleeves of bronze or other suitable alloy.

5. Shaft Seals: Mechanical seals of double carbon and ceramic construction with mating surfaces lapped to flatness tolerance of one light band, held in position with stainless steel spring.

2.03 VALVES

- A. Valves: Provide one gate valve and one check valve on each pump discharge line.

2.04 PIPING

- A. Inlet and Outlet Piping: Same type of pipe and jointing as specified for sanitary sewer to which pump station will be connected.

2.05 PUMP AND LEVEL CONTROL PANEL

- A. Manufacturers:
 1. Substitutions: See Section 016000 - Product Requirements.
- B. Control Panel:
 1. Factory sized, wired, and tested assembly within NEMA 250 Type 4X hinged door enclosure.
 2. Hand-Off-Auto selectable switch with illuminated green start and red stop switches.
 3. Mushroom type emergency stop switch interconnected with open fault auxiliary contacts for field installed safeties. Include audio-visual panel alarm and fault indicators.
 4. Adjustable on delay and off delay pump relays tied to pump starter interface contacts.
 5. Identification Plate:
 - a. Engraved plate to show uppercase white letters on black background.
 - b. 1st Line: PUMP AND LEVEL CONTROL PANEL.
 - c. 2nd Line: System Voltage (e.g. 208V, 3PH or 480V, 3PH) listing power source.
- C. Control Panel Interface:
 1. Provide field-installed pilot-operated solenoid valve with limit switch.
 2. Provide control-panel mounted pump starter.
 3. Provide field-installed level switch.

2.06 INSTRUMENTATION AND CONTROLS

- A. Automatic Controls: Provide automatic controls for pump and other equipment operation, with local manual controls.
- B. Pump Controls: Provide float-operated water level switch to start and stop pump.

2.07 POWER

- A. Electrical Power Available: As indicated on drawings.

2.08 SOURCE QUALITY CONTROL

- A. Test pump, valve, and piping assembly in factory prior to shipping, at test pressure equal to 50 percent more than pump discharge pressure or total dynamic head, whichever is greater.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify inlet and discharge piping connection match size, location, and elevation shown on drawings.

3.02 INSTALLATION

- A. Install as indicated, in accordance with drawings and manufacturer's instructions.
- B. Where equipment is mounted on concrete, grout attachments before connecting piping.
- C. Set water level controls at elevations indicated; if not indicated, obtained Owner's instructions as to levels.

3.03 MANUFACTURER FIELD SERVICES

- A. Provide the services of equipment manufacturer's technical representative to direct startup of station and instruct Owner's personnel in startup, operation, and maintenance procedures.

3.04 FIELD QUALITY CONTROL

- A. Where components are mounted on or in concrete, wait minimum of 5 days after concrete placement before testing.
- B. After installation but before backfilling or connecting to sewer piping, test pump, valve, and piping assemblies under test pressure equal to 50 percent more than pump discharge pressure or total dynamic head, whichever is greater, using clean water. Backfill in accordance with Section 312323.
 - 1. Simulate varying water level conditions to show that pump controls are working properly.
 - 2. Activate each control function to check for proper operation and indication.
 - 3. Include alarm conditions to show that alarms are correctly connected and functioning.
- C. Grinder Pumps:
 - 1. Test pumps and controls, in operation, under design conditions to insure proper operation of all equipment.
 - 2. Provide all appliances, materials, water, and equipment for testing, and bear all expenses in connection with the testing.
 - 3. Conduct testing after all equipment is properly installed, electrical services and piping are installed, liquid is flowing, and the pump station is ready for operation.
 - 4. Correct all defects discovered to the satisfaction of the Owner, and all tests repeated, at the expense of the Contractor, until the equipment is in proper working order
- D. After connecting to sewer piping, monitor operation for 10 days and submit report.

END OF SECTION 221343

**SECTION 223000
PLUMBING EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water heaters.
- B. Diaphragm-type compression tanks.
- C. In-line circulator pumps.

1.02 REFERENCE STANDARDS

- A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data:
 - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
 - 2. Indicate pump type, capacity, power requirements.
 - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
 - 4. Provide electrical characteristics and connection requirements.
- C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Certifications:
 - 1. Water Heaters: NSF approved.
 - 2. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1, as applicable, in addition to requirements specified elsewhere.
 - 3. Pressure Vessels for Heat Exchangers: ASME labeled to ASME BPVC-VIII-1.
 - 4. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
 - 5. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.01 WATER HEATERS

- A. Commercial Gas Fired:
 - 1. Manufacturers:
 - a. Lochinvar.
 - b. PVI
 - 2. Type: Automatic, natural gas-fired, vertical storage.
 - 3. Performance:
 - a. Maximum Working Pressure: 150 psig.
 - 4. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.

5. Accessories:
 - a. Water Connections: Brass.
 - b. Dip Tube: Brass.
 - c. Drain valve.
 - d. Anode: Magnesium.
 - e. Temperature and Pressure Relief Valve: ASME labeled.
6. Applications:
 - a. Automatic storage water heater.
 - b. Automatic circulating tank water heater.
 - c. For operation in high altitude installations.
7. Controls: Automatic direct immersion thermostat with temperature range adjustable minimum 175 degrees F differential, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, intermittent electronic ignition monitoring pilot and main flame, trial for re-ignition for momentary loss of flame, shutdown of pilot and main burner in "2 to 4" seconds after loss of flame, and automatic flue damper.

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Manufacturers:
 1. Amtrol Inc: www.amtrol.com/#sle.
 2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
 3. Taco, Inc: www.taco-hvac.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 40 psig.

2.03 IN-LINE CIRCULATOR PUMPS

- A. Manufacturers:
 1. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
 2. Grundfos.
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.
- C. Impeller: Bronze.
- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
- E. Seal: Carbon rotating against a stationary ceramic seat.
- F. Drive: Flexible coupling.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- C. Pumps:
 1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- D. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote front-end interface; see Section 251500.

END OF SECTION 223000

**SECTION 224000
PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flush valve water closets.
- B. Wall hung urinals.
- C. Lavatories.
- D. Sinks.
- E. Under-lavatory pipe supply covers.
- F. Bottle filling drinking fountains.
- G. Bi-level, electric water coolers.
- H. Mop sinks.

1.02 RELATED REQUIREMENTS

- A. Section 064100 - Architectural Wood Casework: Counters for sinks and lavatories.
- B. Section 079200 - Joint Sealants: Sealing joints between fixtures and walls and floors.
- C. Section 123600 - Countertops: Counters for sinks and lavatories.
- D. Section 221005 - Plumbing Piping.
- E. Section 221006 - Plumbing Piping Specialties.
- F. Section 223000 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration 2008 (Reaffirmed 2013).
- C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).
- D. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2022).
- F. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018, with Errata.
- G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures 2022.
- H. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks 2022.
- I. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices 2020.
- J. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping 2021.
- K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- M. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.
- N. NSF 372 - Drinking Water System Components - Lead Content 2022.
- O. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

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

- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.07 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.

2.03 FLUSH VALVE WATER CLOSETS

- A. Water Closets:
 - 1. Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
 - 2. Flush Valve: Exposed (top spud).
 - 3. Flush Operation: Sensor operated hard wired, or manual. See plumbing fixture schedule for type.
 - 4. Handle Height: 44 inches or less.
 - 5. Color: White.
 - 6. Manufacturers:
 - a. American Standard, Inc; Baby Devoro, 2-Piece Gravity: www.americanstandard-us.com/#sle.
 - b. Kohler Company: www.kohler.com/#sle.
 - c. Zurn Industries, LLC: www.zurn.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
- B. Flush Valves:
 - 1. Manufacturers:
 - a. Sloan Valve Company: www.sloanvalve.com/#sle.
 - b. Zurn Industries, LLC; ZEMS Series: www.zurn.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
 - 2. Manual Operated:
 - a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type complete with vacuum breaker stops, and accessories.
 - b. Supplied Volume Capacity: 1.5 gal per flush.
 - 3. Sensor-Operated:

- a. Mechanism: Solenoid-operated piston or electronic motor-actuated operator with low-voltage hard wired powered infrared sensor, and mechanical override or override push button.
- C. Toilet Seats:
1. Plastic: Solid, white finish, elongated shape, open front, slow-closing hinged seat cover, extended back complete with self-sustaining hinges, and brass bolts with covers.
 2. Plastic: Black finish, open front, extended back, self-sustaining hinge, brass bolts, with cover.
 3. Plastic: Black finish, open front, extended back, self-sustaining hinge, brass bolts, with cover.
- D. Water Closet Carriers:
1. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.04 WALL HUNG URINALS

- A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
 2. Kohler Company: www.kohler.com/#sle.
 3. Zurn Industries, LLC: www.zurn.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Consumption Volume: 1.0 gal per flush, maximum.
 2. Flush Valve: Exposed (top spud).
 3. Flush Operation: Sensor operated.
 4. Trapway Outlet: Integral.
- C. Flush Valves:
1. Manufacturers:
 - a. American Standard, Inc: www.americanstandard-us.com/#sle.
 - b. Sloan Valve Company: www.sloanvalve.com/#sle.
 - c. Zurn Industries, LLC; ZEMS Series: www.zurn.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
 2. Sensor-Operated:
 - a. Type: ASME A112.19.5; chloramine-resistant, clog-resistant dual-seat diaphragm valve with vacuum breaker stops and accessories.
 - b. Mechanism: Solenoid-operated piston or electronic motor-actuated operator with low-voltage hard wired powered infrared sensor, and mechanical override or override push button.
 - c. Supplied Volume Capacity: 1.0 gal per flush.
 3. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.
- D. Urinal Carriers:
1. Manufacturers:
 - a. JOSAM Company: www.josam.com/#sle.
 - b. Zurn Industries, LLC; Z1221: www.zurn.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
 2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.05 LAVATORIES

- A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
 2. Kohler Company: www.kohler.com/#sle.
 3. Zurn Industries, LLC: www.zurn.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.

- B. Wall-Hung Basin:
 - 1. Vitreous China, Grade A: ASME A112.19.2; white rectangular commercial-grade sink with predrilled holes, rear-center drain, front overflow, and hanger. Size as indicated on drawings with 4 inch centerset spacing.
 - 2. Carrier:
 - a. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.
 - b. Manufacturers:
 - 1) Jay R. Smith MFG. Co: www.jrsmith.com/#sle.
 - 2) JOSAM Company: www.josam.com/#sle.
 - 3) Zurn Industries, LLC; Z1231: www.zurn.com/#sle.
 - 4) Substitutions: See Section 016000 - Product Requirements.
- C. Drop-In Basin:
 - 1. Vitreous China: ASME A112.19.2; self-rimming, white, square shape, front overflow, soap depression, seal of putty, calking, or concealed vinyl gasket, and white finish. Size as indicated on drawings with 4 inch centerset spacing.
- D. Sensor Operated Faucet: Cast brass, chrome-plated, deck mounted with sensor located on neck of spout.
 - 1. Cast brass, chrome plated, deck mounted with sensor located on neck of spout.
 - 2. Spout Style: Standard.
 - 3. Power Supply:
 - a. Hard wired: 24 VDC, field-wired into dedicated or common power supply.
- E. Thermostatic Mixing Valve:
 - 1. ASSE 1070 listed with combination stop, strainer, and check valves, and flexible stainless steel connectors.

2.06 SINKS

- A. Manufacturers:
 - 1. American Standard, Inc: www.americanstandard-us.com/#sle.
 - 2. Kohler Company: www.kohler.com/#sle.
 - 3. Elkay.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Single Compartment Bowl
 - 1. ASME A112.19.3; See plumbing fixture schedule for bowl dimensions. 18 gauge, 0.05 inch thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
 - 2. Drain: 1-1/2 inch chromed brass.
- C. Kitchen Faucets:
 - 1. Manufacturers:
 - a. American Standard, Inc; www.americanstandard-us.com/#sle.
 - b. Zurn.
 - c. Substitutions: See Section 016000 - Product Requirements.
 - 2. Two Handle Faucet:
 - a. Type: Deck-mount, lever operated faucet with mounting plate.
 - b. Spray Type: Full stream spray at 1.5 gpm, maximum.
 - c. ASME A112.18.1, ADA Standards, and NSF 61 compliant assembly.
 - d. Materials: Stainless steel disc valve on brass body with polished chrome finish.

2.07 UNDER-LAVATORY PIPE SUPPLY COVERS

- A. Manufacturers:
 - 1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
- B. General:

1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
 - a. Provide one piece injected molded design with internal bridge at top of J-bend to prevent separating.
 - b. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
 - c. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
 - d. Comply with ICC A117.1.
 - e. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.
3. Color: High gloss white.
4. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

2.08 BOTTLE FILLING DRINKING FOUNTAINS

- A. Manufacturers:
 1. Elkay Manufacturing Company: www.elkay.com/#sle.
- B. Elkay ezH2O® In-Wall Bottle Filling Station with Mounting Frame, High efficiency filtered refrigerated stainless. Chilling capacity of 8 GPH of 50°F drinking water, based on 80°F inlet water temperature and 90°F ambient, per ASHRAE 18 testing.
- C. Features include:
 1. Antimicrobial, filtered, hands free, high efficiency, laminar flow, real drain, visual filter monitor.
 2. Electronic bottle filler sensor activation.
 3. Wall mounted.
 4. UL 399 listed.
 5. Lead free to NSF/ANSI 61 & 372.
- D. Bottle Filler: Materials to match fountain.

2.09 BI-LEVEL, ELECTRIC WATER COOLERS

- A. Manufacturers:
 1. Elkay Manufacturing Company: www.elkay.com/#sle.
 2. Haws Corporation: www.hawsc.com/#sle.
 3. Oasis International: www.oasiscoolers.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
 1. Capacity: 8 gph of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
 2. Electrical: 115 VAC, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.
- C. Bottle Filler: Materials to match fountain.

2.10 MOP SINKS

- A. Manufacturers:
 1. Acorn Engineering Company: www.acorneng.com/#sle.
 2. Zurn Industries, LLC: www.zurn.com/#sle.
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Material: Enameled cast iron.
- C. Type: Corner mounted.
- D. Grid Strainer: Stainless steel; integral; removable.

- E. Dimensions: As indicated on drawings.
- F. Accessories:
 - 1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
 - 2. Hose clamp hanger.
 - 3. Mop hanger.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Install components level and plumb.
- C. Install and secure fixtures in place with wall supports and bolts.
- D. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

- A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Do not permit use of fixtures by construction personnel.
- C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 224000

**SECTION 224600
SECURITY PLUMBING FIXTURES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Combination units.

1.02 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.
- B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.
- C. ASME A112.18.2 - Plumbing Waste Fittings 2020.
- D. ASME A112.18.6 - Flexible Water Connectors 2017 (Reaffirmed 2021).
- E. ASME A112.19.3 - Stainless Steel Plumbing Fixtures 2022.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.
 - 2. Include illustrations of fixture sizes, rough-in dimensions, utility sizes, trim, and finishes.
 - 3. Manufacturer's Instructions: Indicate installation methods and procedures.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specialized in manufacturing of product types specified in this section with minimum of three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inspect received fixtures for damages and keep fixtures in respective factory packaging.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.01 COMBINATION UNITS

- A. Manufacturers:
 - 1. Acorn Engineering Company, Inc: www.acorneng.com/#sle.
- B. Ligature-resistant, 49.25 inch-width, toilet-lavatory combination unit.
- C. Toilet:
 - 1. Chase-mounted, 90-degree bowl with siphon jet flush, flushometer, trap and back-outlet.
 - 2. Flush Capacity: Ultra-low flow (ULF) at 1.6 gallons at 35 psi.
 - 3. Seat Type and Rim Height: Handicap-ADA compliant, 18 inch, contoured.
- D. Lavatory:
 - 1. Pre-installed vandal-resistant metering, non-hold open faucet.
 - 2. Flow Capacity: 0.7 gallons at 25 psi. Timing adjustable from 5 to 60 seconds.
 - 3. Inlet Size and Valve Location: 3/4 inch, concealed (back spud).
- E. Material:

1. Exposed Surface Finish: Polished to satin finish.
2. Material: ASME A112.19.3, seamless welded 304 stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power at device-listed rating is available to connect control products. Then wire and terminate in per Section 260583 requirements.

3.02 PREPARATION

- A. Set fixture-height in accordance with manufacturer recommendations otherwise apply the values listed within section schedule per particular fixture.
- B. Set fixture rough-in piping connection sizes in accordance manufacturer recommendations otherwise apply minimum values per service listed within section schedule per particular fixture.

3.03 REGULATORY REQUIREMENTS

- A. Perform work in accordance with local health department regulations.
- B. Provide installation compliance certificate from Authority Having Jurisdiction.

3.04 INSTALLATION

- A. Provide fixture rough-in's with interconnecting fittings per Section 221005 requirements.
- B. Provide supply fittings per fixture type as recommended in ASME A112.18.1.
- C. Provide waste fittings per fixture type as recommended in ASME A112.18.2.
- D. Provide flexible supply connectors per lavatory as recommended in ASME A112.18.6.
- E. Install fixtures and fittings in accordance with the manufacturer's instructions.
- F. Caulk fixtures and accessories as indicated.
- G. Install flushometer and faucets at prescribed heights in compliance with ADA Standards.
- H. Install, level, and secure fixtures in place with wall supports, and bolts.
- I. Install fixture valves, traps, and related service components at reasonable locations free of limited space or obstructions to ensure easy removal for servicing and cleaning.
- J. Install components, level, and plumb each fixture utility service component.
- K. Place remote-activated thermostatically actuated bleed valve(s) behind wall or buried below frost line.

3.05 ADJUSTING

- A. Adjust water flow rates to comply with manufacturer's rating of the fixture.
- B. Adjust fixture further stops or valves water flow rates without splashing, noise, or overflow.

3.06 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory functional, and operating performance.

3.07 CLEANING

- A. Thoroughly clean plumbing fixtures and equipment both internally and externally.
- B. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

3.08 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.

- B. Repair or replace products damaged prior to issuing Certificate of Substantial Completion.

END OF SECTION 224600

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**SECTION 230513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General construction and requirements.
- B. Applications.
- C. Single phase electric motors.
- D. Three phase electric motors.

1.02 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings 2015 (Reaffirmed 2020).
- B. NEMA MG 1 - Motors and Generators 2021.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Construction:
 - 1. Open drip-proof type except where specifically noted otherwise.
 - 2. Design for continuous operation in 104 degrees F environment.
 - 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
- B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- C. Wiring Terminations:
 - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
 - 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.02 APPLICATIONS

- A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.
- B. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.
- C. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.

2.03 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

- A. Starting Torque: Exceeding one fourth of full load torque.
- B. Starting Current: Up to six times full load current.
- C. Multiple Speed: Through tapped windings.

- D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.04 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than five times full load current.
- C. Pull-up Torque: Up to 350 percent of full load torque.
- D. Breakdown Torque: Approximately 250 percent of full load torque.
- E. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

2.05 THREE PHASE POWER - SQUIRREL CAGE MOTORS

- A. Starting Torque: Between 1 and 1-1/2 times full load torque.
- B. Starting Current: Six times full load current.
- C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
- D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.
- E. Insulation System: NEMA Class B or better.
- F. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- G. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION 230513

**SECTION 230529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment components.

1.02 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- E. MFMA-4 - Metal Framing Standards Publication 2004.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
 - 1. Comply with MFMA-4.
- C. Hanger Rods:
 - 1. Threaded zinc-plated steel unless otherwise indicated.
- D. Pipe Shields for Insulated Piping:
 - 1. General Construction and Requirements:
 - a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
 - b. Shields Material: UV-resistant polypropylene with glass fill.
 - c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
 - d. Minimum Service Temperature: Minus 40 degrees F.
 - e. Maximum Service Temperature: 178 degrees F.
 - f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

- E. Anchors and Fasteners:
 - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

END OF SECTION 230529

**SECTION 230548
VIBRATION AND SEISMIC CONTROLS FOR HVAC**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Vibration isolation requirements.
- B. Vibration-isolated equipment support bases.
- C. Vibration isolators.
- D. External seismic snubber assemblies.
- E. Vibration-isolated and/or seismically engineered roof curbs.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.
- C. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
 - 1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

- A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.
- B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:
- C. General Requirements:
 - 1. Select vibration isolators to provide required static deflection.
 - 2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
 - 3. Select vibration isolators for outdoor equipment to comply with wind design requirements.
- D. Equipment Isolation:

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

- A. Vibration-Isolated Structural Steel Bases:
 - 1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
 - 2. Centrifugal Fan Applications: Provide adjustable motor slide rails as required.
- B. Vibration-Isolated Concrete Inertia Bases:
 - 1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
 - 2. Minimum Base Depth: 6 inches.

3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 033000.

2.03 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
 - a. Color code or otherwise identify springs to indicate load capacity.
 - b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
 - c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
 - d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
 - e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
 - f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
 - a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 - b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

B. Vibration Isolators for Nonseismic Applications:

1. Resilient Material Isolator Pads:
 - a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
 - b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
 - c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Housed Spring Isolators:
 - a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
 - b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
 - c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
 - d. Furnished with integral leveling device for positioning and securing supported equipment.
3. Spring Isolator Hangers, Nonseismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

C. Vibration Isolators for Seismic Applications:

1. Resilient Material Isolator Mounts, Seismic:
 - a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:

- a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
- b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
- c. Furnished with integral leveling device for positioning and securing supported equipment.
- d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
 - a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
 - b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.04 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

- A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.
- B. Seismic Snubbing Elements:
 1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
 2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.05 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

- A. Vibration Isolation Curbs:
 1. Nonseismic Curb Rail:
 - a. Location: Between existing roof curb and rooftop equipment.
 - b. Construction: Aluminum.
 - c. Integral vibration isolation to comply with requirements of this section.
 - d. Weather exposed components consist of corrosion resistant materials.
 2. Nonseismic Curb:
 - a. Location: Between structure and rooftop equipment.
 - b. Construction: Aluminum.
 - c. Integral vibration isolation to comply with requirements of this section.
 - d. Weather exposed components consist of corrosion resistant materials.
 3. Seismic Curb:
 - a. Location: Between structure and rooftop equipment.
 - b. Construction: Steel.
 - c. Integral vibration isolation to comply with requirements of this section.
 - d. Snubbers consist of minimum 0.25 inch thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
 - e. Weather exposed components consist of corrosion resistant materials.
- B. Seismic Type Nonisolated Curb and Fabricated Equipment Piers:
 1. Location: Between structure and rooftop equipment.

2. Construction: Steel.
3. Weather exposed components consist of corrosion resistant materials.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Secure fasteners according to manufacturer's recommended torque settings.
- C. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.
- D. Vibration Isolation Systems:
 1. Vibration-Isolated Equipment Support Bases:
 - a. Provide specified minimum clearance beneath base.
 2. Spring Isolators:
 - a. Position equipment at operating height; provide temporary blocking as required.
 - b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
 - c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
 3. Isolator Hangers:
 - a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
 - b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
 4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
 5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
 6. Adjust isolators to be free of isolation short circuits during normal operation.
 7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION 230548

**SECTION 230593
TESTING, ADJUSTING, AND BALANCING FOR HVAC**

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

- A. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.
- B. Section 230800 - Commissioning of HVAC.

1.02 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
 - b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
- D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.03 COMMISSIONING

- A. See Sections 019113 - General Commissioning Requirements and 230800 for additional requirements.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Fill out Prefunctional Checklists for:
 - 1. Air side systems.
 - 2. Water side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 25 percent of the air handlers plus a random sample equivalent to percent of the final TAB report data as directed by Commissioning Authority.
 - 1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
 - 2. Use the same test instruments as used in the original TAB work.

3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
 4. For purposes of re-check, failure is defined as follows:
 - a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
 - b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.
 - c. Temperatures: Deviation of more than one degree F.
 - d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
 - e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.
 5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.
- F. In the presence of the Commissioning Authority, verify that:
1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
 2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
 3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

END OF SECTION 230593

**SECTION 230713
DUCT INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.
- C. Jacketing and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2023.
- C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com/#sle.
 - 3. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 1,200 degrees F.

2.03 GLASS FIBER, RIGID

- A. Insulation: ASTM C612; rigid, noncombustible blanket.
 - 1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 450 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent.

2.04 JACKETING AND ACCESSORIES

- A. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square.
- B. Flexible Weather-Proofing Outdoor Jacket: Self-healing, field-applied outdoor cladding.

1. Material: Aluminum foil/polymer laminate with rubberized asphalt layer and acrylic adhesive.
 2. Water Vapor Transmission: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
- C. Reinforced Tape:
1. Metallized polypropylene tape suitable for continuous spiral wrapping of insulated pipe bends and fittings resulting in a tight, smooth surface without wrinkles.

2.05 DUCT LINER

- A. Manufacturers:
1. Armacell LLC; AP Coilflex: www.armacell.us/#sle.
 2. CertainTeed Corporation: www.certainteed.com/#sle.
 3. Johns Manville: www.jm.com/#sle.
- B. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 180 degrees F.
 3. Fungal Resistance: No growth when tested according to ASTM G21.
 4. Connection: Waterproof vapor barrier adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Insulated Ducts Conveying Air Below Ambient Temperature:
 1. Provide insulation with vapor barrier jackets.
- C. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.
- D. Slope exterior ductwork to shed water.
- E. External Duct Insulation Application:
 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
- F. Duct and Plenum Liner Application:
 1. Adhere insulation with adhesive for 90 percent coverage.
 2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
 3. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

END OF SECTION 230713

**SECTION 230719
HVAC PIPING INSULATION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

- A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019, with Editorial Revision (2023).
- C. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2019).
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2023.
- F. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.
- G. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2022.
- H. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- I. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2022.
- J. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing 2022.
- K. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation 2022.
- L. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- M. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation 2019.
- N. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation 2023.
- O. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation 2017 (Reapproved 2023).
- P. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation 2021.
- Q. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber 2020.
- R. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics 2016.
- S. ASTM D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics 2017.

- T. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics 2019.
- U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- V. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- W. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth 2016b.
- X. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 CELLULAR MELAMINE

- A. Insulation: Flexible preformed open-cell polymeric foam tubing, slit lengthwise for installation, complying with applicable requirements of ASTM C1410.
 - 1. K Value: ASTM C177; 0.25 at 75 degrees F.
 - 2. Minimum Service Temperature: Minus 40 degrees F.
 - 3. Maximum Service Temperature: 350 degrees F.
 - 4. Density: 0.56 pcf.
 - 5. Factory-Applied Jacketing Material: Paper/Foil/Scrim.

2.03 GLASS FIBER, FLEXIBLE

- A. Manufacturers:
 - 1. JP Lamborn Co; Thermal Sleeve MT: www.jpflex.com/#sle.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
 - 1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
 - 2. Maximum Service Temperature: 1,200 degrees F.
 - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
 - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
 - 2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
 - 3. Secure with pressure-sensitive tape.

2.04 GLASS FIBER, RIGID

- A. Manufacturers:
 - 1. CertainTeed Corporation: www.certainteed.com/#sle.
 - 2. Johns Manville Corporation: www.jm.com/#sle.
 - 3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
 - 4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
 - 5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com/#sle.

- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
 - 1. K Value: ASTM C177, 0.23 at 75 degrees F.
 - 2. Maximum Service Temperature: 220 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- D. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 650 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- E. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- F. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- G. Vapor Barrier Lap Adhesive: Compatible with insulation.
- H. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.05 CELLULAR GLASS

- A. Manufacturers:
 - 1. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
- B. Pipe and Tubing Insulation: ASTM C552, Type II, Grade 6.
 - 1. K Value: 0.35 at 100 degrees F.
 - 2. Service Temperature Range: From 250 degrees F to 800 degrees F.
 - 3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
 - 4. Water Absorption: 0.5 percent by volume, maximum.
 - 5. Density: A minimum of 6.12 pcf.
- C. Block Insulation: ASTM C552, Type I, Grade 6.
 - 1. K Value: 0.35 at 100 degrees F.
 - 2. Service Temperature: 800 degrees F, maximum.
 - 3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
 - 4. Water Absorption: 0.5 percent by volume, maximum.

2.06 EXPANDED POLYSTYRENE

- A. Insulation: ASTM C578; rigid closed cell.
 - 1. K Value: 0.23 at 75 degrees F.
 - 2. Maximum Service Temperature: 165 degrees F.
 - 3. Maximum Water Vapor Permeance: 5.0 perm.

2.07 POLYISOCYANURATE CELLULAR PLASTIC

- A. Insulation Material: ASTM C591, rigid molded modified polyisocyanurate cellular plastic.
 - 1. Dimension: Comply with requirements of ASTM C585.
 - 2. K Value: 0.18 at 75 degrees F, when tested in accordance with ASTM C518.
 - 3. Minimum Service Temperature: Minus 70 degrees F.
 - 4. Maximum Service Temperature: 300 degrees F.
 - 5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D2842.
 - 6. Moisture Vapor Transmission: 4.0 perm inch.

7. Connection: Waterproof vapor barrier adhesive.

2.08 POLYETHYLENE

- A. Manufacturers:
 1. Armacell LLC: www.armacell.us/#sle.
- B. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
 1. K Value: ASTM C177; 0.25 at 75 degrees F.
 2. Maximum Service Temperature: 300 degrees F.
 3. Density: 2 pcf.
 4. Maximum Moisture Absorption: 1.0 percent by volume.
 5. Moisture Vapor Permeability: 0.05 perm inch, when tested in accordance with ASTM E96/E96M.
 6. Connection: Contact adhesive.

2.09 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturers:
 1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): www.aeroflexusa.com/#sle.
 2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
 3. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
 1. Minimum Service Temperature: Minus 40 degrees F.
 2. Maximum Service Temperature: 180 degrees F.
 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
- D. Weather Barrier Coating: Air dried, contact adhesive, compatible with insulation and ASTM E84 compliant.
 1. Manufacturers:
 - a. Vimasco Corporation: www.vimasco.com/#sle.

2.10 RIGID, CELLULAR PHENOLIC

- A. Manufacturers:
 1. Dyplast Products, LLC: www.dyplastproducts.com/#sle.
 2. ITW Insulation Systems: www.itwinsulation.com/#sle.
 3. Polyguard Products; PolyPhen: www.polyguardproducts.com.com/#sle.
- B. Insulation: ASTM C1126, Type III, Grade 1.
 1. Nominal Density: 3.75 pcf.
 2. Preliminary Initial Minimum K Value: 0.145 at 50 degrees F based on density of 2.5 pcf.
 3. Maximum Service Temperature: 248 degrees F.
 4. Minimum Service Temperature: Minus 292 degrees F.
 5. Minimum compressive strength as determined by ASTM D1621.
 6. Minimum tensile strength as determined by ASTM D1623.

2.11 EXTRUDED POLYSTYRENE (XPS) BOARD INSULATION

- A. Manufacturers:
 1. Polyguard Products; Dow Styrofoam PIB: www.polyguardproducts.com/#sle.
- B. Comply with ASTM E84.
- C. Insulation: ASTM C578; rigid closed cell.
 1. K Value: 0.23 at 75 degrees F.
 2. Maximum Service Temperature: 165 degrees F.
 3. Maximum Water Vapor Permeance: 5.0 perm.

- D. Billet Dimensions: 7 inches by 14 inches by 108 inches.
- E. Density: Type X, 1.30 pcf (21 kg/cu m), minimum.
- F. Water Absorption: Type X, 0.3 percent by volume, maximum, by total immersion.

2.12 JACKETING AND ACCESSORIES

- A. PVC Plastic:
 - 1. Manufacturers:
 - a. Johns Manville Corporation: www.jm.com/#sle.
 - 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil, 0.010 inch.
 - e. Connections: Brush on welding adhesive.
- B. Aluminum Jacket:
 - 1. Manufacturers:
 - a. Ideal Tape Co., Inc: www.abitape.com/#sle.
 - 2. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
 - 3. Thickness: 0.016 inch sheet.
 - 4. Finish: Embossed.
 - 5. Joining: Longitudinal slip joints and 2 inch laps.
 - 6. Fittings: 0.016 inch thick die-shaped fitting covers with factory-attached protective liner.
 - 7. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
 - 8. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.
- C. Reinforced Tape:
 - 1. Manufacturers:
 - 2. Metallized polypropylene tape suitable for continuous spiral wrapping of insulated pipe bends and fittings resulting in a tight, smooth surface without wrinkles.
 - 3. Comply with UL 723, SAE AMS3779, and ASTM C1423.
 - 4. Finish: Match insulation.
- D. Foil Mastic Tape:
 - 1. Manufacturers:
 - a. Ideal Tape Co., Inc: www.abitape.com/#sle.
 - 2. Kraft paper bonded to aluminized film with pressure-sensitive rubber-based adhesive.
- E. Vapor Barrier Membranes: ASTM C1136, Type IX.
 - 1. Multilayer Laminate Vapor Barrier:
 - a. Provide multilayer laminate with 1.0 mil, 0.001 inch foil, reversible.
 - b. Thickness: 2.4 mil, 0.002 inch.
 - c. Moisture Vapor Permeability: 0.00 perm inch, when tested in accordance with ASTM E96/E96M.
 - d. Manufacturers:
 - 1) Polyguard Products; ZERO-PERM: www.polyguardproducts.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
 - 1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
 - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- G. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- H. Glass Fiber Insulated Pipes Conveying Fluids Above Ambient Temperature:
 - 1. Provide standard jackets, with or without vapor barrier, factory-applied, or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- I. Inserts and Shields:
 - 1. Application: Piping 1-1/2 inches diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert location: Between support shield and piping and under the finish jacket.
 - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.
- K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.
- L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.
- M. Buried Piping: Provide factory-fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with 1 mil, 0.001 inch thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with polyester film.
- N. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

END OF SECTION 230719

SECTION 230800 COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

- A. The commissioning authority (CA) is hired by the owner. The contractor shall work with the CA as described in this specification section.
- B. See Section 019113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.
- C. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.
- D. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.
- E. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
 - 1. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
- F. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 REFERENCE STANDARDS

- A. ASHRAE Guideline 1.1 - HVAC&R Technical Requirements for the Commissioning Process 2007, with Errata (2012).

1.03 SUBMITTALS

- A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.
- B. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.
- C. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
 - 1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
 - 2. Full as-built set of control drawings.
 - 3. Full as-built sequence of operations for each piece of equipment.
 - 4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
 - a. Floor.
 - b. Room number.
 - c. Room name.
 - d. Air handler unit ID.
 - e. Reference drawing number.
 - f. Air terminal unit tag ID.
 - g. Heating and/or cooling valve tag ID.
 - h. Minimum air flow rate.
 - i. Maximum air flow rate.
 - 5. Full print out of all schedules and set points after testing and acceptance of the system.

6. Full as-built print out of software program.
 7. Electronic copy on disk of the entire program for this facility.
 8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
 9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
 10. Control equipment component submittals, parts lists, etc.
 11. Warranty requirements.
 12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
 13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
 - a. Sequences of operation.
 - b. Control drawings.
 - c. Points lists.
 - d. Controller and/or module data.
 - e. Thermostats and timers.
 - f. Sensors and DP switches.
 - g. Valves and valve actuators.
 - h. Dampers and damper actuators.
 - i. Program setups (software program printouts).
- D. Project Record Documents: See Section 017800 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
 2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.
- E. Draft Training Plan: In addition to requirements specified in Section 017900, include:
1. Follow the recommendations of ASHRAE Guideline 1.1.
 2. Control system manufacturer's recommended training.
 3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.
- F. Training Manuals: See Section 017900 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

- A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.
- B. Furnish additional information requested by the Commissioning Authority.

- C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.
- D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.
- E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
- F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.
- G. Provide temperature and pressure taps in accordance with Contract Documents.

3.02 INSPECTING AND TESTING - GENERAL

- A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
- B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
- C. Provide two-way radios for use during the testing.
- D. Valve/Damper Stroke Setup and Check:
 - 1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
 - 2. Set pump/fan to normal operating mode.
 - 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
 - 4. Command valve/damper open; verify position is full open and adjust output signal as required.
 - 5. Command valve/damper to a few intermediate positions.
 - 6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- E. Isolation Valve or System Valve Leak Check: For valves not by coils.
 - 1. With full pressure in the system, command valve closed.
 - 2. Use an ultra-sonic flow meter to detect flow or leakage.
- F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

- A. TAB: Testing, adjusting, and balancing of HVAC.
- B. Coordinate commissioning schedule with TAB schedule.
- C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.
- D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.
- E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.
- F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

- A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.
- B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.
- C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.
- D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
 - 1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
 - 2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.
- E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.
- F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
 - 1. Setpoint changing features and functions.
 - 2. Sensor calibrations.
- G. Demonstrate to the Commissioning Authority:
 - 1. That all specified functions and features are set up, debugged and fully operable.
 - 2. That scheduling features are fully functional and setup, including holidays.
 - 3. That all graphic screens and value readouts are completed.
 - 4. Correct date and time setting in central computer.
 - 5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
 - 6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
 - 7. Power failure and battery backup and power-up restart functions.
 - 8. Global commands features.
 - 9. Security and access codes.
 - 10. Occupant over-rides (manual, telephone, key, keypad, etc.).
 - 11. O&M schedules and alarms.
 - 12. Occupancy sensors and controls.
 - 13. All control strategies and sequences not tested during controlled equipment testing.
- H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. See Section 017800 for additional requirements.

- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

- A. See Section 017900 for additional requirements.
- B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
- C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.
- D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:
- E. TAB Review: Instruct Owner's personnel for minimum 4 hours, after completion of TAB, on the following:
 - 1. Review final TAB report, explaining the layout and meanings of each data type.
 - 2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
 - 3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
 - 4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
 - 5. Other salient information that may be useful for facility operations, relative to TAB.
- F. HVAC Control System Training: Perform training in at least three phases:
 - 1. Phase 1 - Basic Control System: Provide minimum of 4 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
 - a. This training may be held on-site or at the manufacturer's facility.
 - b. If held off-site, the training may occur prior to final completion of the system installation.
 - c. For off-site training, Contractor shall pay expenses of up to two attendees.
 - 2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 4 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:
 - a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.
 - b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
 - c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.

- d. Every display screen, allowing time for questions.
- e. Point database entry and modifications.
- 3. Phase 3 - Post-Occupancy: Six months after occupancy conduct minimum of 4 hours of training. Tailor training session to questions and topics solicited beforehand from Owner. Also be prepared to address topics brought up and answer questions concerning operation of the system.
- G. Provide the services of manufacturer representatives to assist instructors where necessary.
- H. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION 230800

SECTION 230923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. System description.
- B. Operator interface.
- C. Sensors.
- D. Controller software.
- E. HVAC control programs.

1.02 RELATED REQUIREMENTS

- A. Section 230993 - Sequence of Operations for HVAC Controls.
- B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for each system component and software module.
- C. Shop Drawings:
 - 1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
 - 2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.
 - 3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
 - 4. Indicate description and sequence of operation of operating, user, and application software.
- D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
 - 1. Revise shop drawings to reflect actual installation and operating sequences.
 - 2. Include submittals data in final "Record Documents" form.
- E. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a one year period after Substantial Completion.
- C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. i-Vu by Carrier..
- B. Substitutions: Not Permitted.

2.02 SYSTEM DESCRIPTION

- A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.
- B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

- C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- D. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
- E. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

- A. PC Based Work Station:
 - 1. Connected to server for full access to all system information.
- B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.
- C. Security:
 - 1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on. This includes displays as outlined above.

2.04 CONTROLLERS

- A. Building Controllers:
 - 1. General:
 - a. Building controller shall be Carrier and iVu compatible and approved by the BTL as meeting the BACnet building controller requirements.
 - b. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
 - c. Provide sufficient memory to support controller's operating system, database, and programming requirements.
 - d. Share data between networked controllers.
 - e. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
 - f. Utilize real-time clock for scheduling.
 - g. Continuously check processor status and memory circuits for abnormal operation.
 - h. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
 - i. Communication with other network devices to be based on assigned protocol.
 - 2. Communication:
 - a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
 - b. Perform routing when connected to a network of custom application and application specific controllers.
 - c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
 - 3. Anticipated Environmental Ambient Conditions:
 - a. Outdoors and/or in Wet Ambient Conditions:
 - 1) Mount within waterproof enclosures.
 - 2) Rated for operation at 40 to 150 degrees F.
 - b. Conditioned Space:
 - 1) Mount within dustproof enclosures.
 - 2) Rated for operation at 32 to 120 degrees F.
 - 4. Provisions for Serviceability:
 - a. Diagnostic LEDs for power, communication, and processor.

- b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
 5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
 6. Power and Noise Immunity:
 - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
 - b. Perform orderly shutdown below 80 percent of nominal voltage.
 - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.
- B. Application Specific Controllers:
 1. General:
 - a. Provide one or more iVu compatible native BACnet application controllers for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit.
 - b. Customized for operation within the confines of equipment served.
 - c. Communication with other network devices to be based on assigned protocol.
 2. Communication:
 - a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
 - b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
 3. Anticipated Environmental Ambient Conditions:
 - a. Outdoors and/or in Wet Ambient Conditions:
 - 1) Mount within waterproof enclosures.
 - 2) Rated for operation at 40 to 150 degrees F.
 - b. Conditioned Space:
 - 1) Mount within dustproof enclosures.
 - 2) Rated for operation at 32 to 120 degrees F.
 4. Provisions for Serviceability:
 - a. Diagnostic LEDs for power, communication, and processor.
 - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
 5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
 6. Power and Noise Immunity:
 - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
 - b. Perform orderly shutdown below 80 percent of nominal voltage.
 - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.
- C. Input/Output Interface:
 1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
 2. All Input/Output Points:
 - a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
 - b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
 3. Binary Inputs:
 - a. Allow monitoring of On/Off signals from remote devices.
 - b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
 - c. Sense dry contact closure with power provided only by the controller.

4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
 - a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
 - b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
 - a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
 - b. Outputs provided with three position (On/Off/Auto) override switches.
 - c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
 - a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
 - b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
 - c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
 - a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
 - b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
 - c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
 - a. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.05 SENSORS

- A. Thermost:
 1. Thermostats shall be approved by the BTL as meeting the BACnet Application Specific Controller requirements. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
 2. Thermostats shall, at a minimum, support MS/TP BACnet LAN types. They shall communicate directly through this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device.
 3. Base model shall be Carrier ComfortVu BACnet TB-C thermostat.
- B. Temperature Sensors:
 1. All temperature sensors to be solid-state electronic, interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches above finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake, and in a location that is in the shade most of the day.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

- B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 230993.
- C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.02 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate complete and operating system to Owner.
- B. Provide system operator's training to include (but not be limited to) such items as:
 - 1. Provide on-site training up to 40 total hours as part of this contract. System Training Instructor shall instruct owner in operation of systems and equipment.
 - 2. Provide certification documentation for each person that attends the training for every course attended. The instructor must be factory certified to issue class certification.

END OF SECTION 230923

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CSHQA, Inc.
Agency Review Set
April 21, 2023

Theron W. Ward Judicial Building Remodel and Expansion
Twin Falls, Idaho
Project No.: 21403.000

SECTION 230993
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS
PART 2 PRODUCTS - SPECIFIED ON DRAWINGS
END OF SECTION 230993

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**SECTION 232300
REFRIGERANT PIPING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Piping.
- B. Refrigerant.
- C. Moisture and liquid indicators.
- D. Valves.
- E. Strainers.
- F. Check valves.
- G. Pressure regulators.
- H. Pressure relief valves.
- I. Filter-driers.
- J. Solenoid valves.
- K. Expansion valves.
- L. Flexible connections.

1.02 RELATED REQUIREMENTS

- A. Section 083100 - Access Doors and Panels.
- B. Section 230716 - HVAC Equipment Insulation.
- C. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers 2005.
- B. AHRI 710 - Performance Rating of Liquid-Line Driers 2009.
- C. AHRI 750 - Thermostatic Refrigerant Expansion Valves 2007.
- D. AHRI 760 - Performance Rating of Solenoid Valves for Use With Volatile Refrigerants 2007.
- E. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.
- F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.
- G. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2022.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- I. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.
- J. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.
- K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- L. UL 429 - Electrically Operated Valves Current Edition, Including All Revisions.

1.04 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

- B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
- C. Filter-Driers:
 - 1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

2.02 PIPING

- A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
 - 1. Fittings: ASME B16.22 wrought copper.
 - 2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
- B. Pipe Supports and Anchors:
 - 1. Provide hangers and supports that comply with MSS SP-58.
 - a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
 - 2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
 - 3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
 - 4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
 - 5. Vertical Support: Steel riser clamp.
 - 6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
 - 7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
 - 8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.03 REFRIGERANT

- A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.04 MOISTURE AND LIQUID INDICATORS

- A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.05 VALVES

- A. Diaphragm Packless Valves:
 - 1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.
- B. Ball Valves:
 - 1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.
- C. Service Valves:
 - 1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.06 STRAINERS

- A. Straight Line or Angle Line Type:
 - 1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.07 CHECK VALVES

- A. Globe Type:
 - 1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.
- B. Straight Through Type:
 - 1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.08 PRESSURE REGULATORS

- A. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi range, for maximum working pressure of 450 psi.

2.09 PRESSURE RELIEF VALVES

- A. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi.

2.10 FILTER-DRIERS

- A. Performance:
 - 1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710.
 - 2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
 - 3. Design Working Pressure: 350 psi, minimum.
- B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.
- C. Construction: UL listed.
 - 1. Connections: As specified for applicable pipe type.

2.11 SOLENOID VALVES

- A. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.
- B. Coil Assembly: UL 429 UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

2.12 ELECTRONIC EXPANSION VALVES

- A. Valve:
 - 1. Brass body with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.
- B. Evaporation Control System:
 - 1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, preselection allowance for electrical defrost and hot gas bypass.

2.13 FLEXIBLE CONNECTORS

- A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

- A. Install refrigeration specialties in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Pipe Hangers and Supports:
 - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 2. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 3. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
- F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.
- I. Flood piping system with nitrogen when brazing.
- J. Insulate piping and equipment.
- K. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.
- L. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.
- M. Fully charge completed system with refrigerant after testing.
- N. Provide electrical connection to solenoid valves. See Section 260583.

END OF SECTION 232300

**SECTION 233100
HVAC DUCTS AND CASINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.
- C. Casings and plenums.

1.02 RELATED REQUIREMENTS

- A. Section 230593 - Testing, Adjusting, and Balancing for HVAC.
- B. Section 230713 - Duct Insulation: External insulation and duct liner.
- C. Section 233300 - Air Duct Accessories.
- D. Section 233600 - Air Terminal Units.
- E. Section 233700 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for duct materials.
- C. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work for systems.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. Ducts: Galvanized steel, unless otherwise indicated.
- C. Low Pressure Supply (Heating Systems): 2 inch wg pressure class, galvanized steel.
- D. Low Pressure Supply (System with Cooling Coils): 2 inch wg pressure class, galvanized steel.
- E. Return and Relief: 1 inch wg pressure class, galvanized steel.
- F. General Exhaust: 1 inch wg pressure class, galvanized steel.
- G. Outside Air Intake: 1/2 inch wg pressure class, galvanized steel.
- H. Combustion Air: 1/2 inch wg pressure class, galvanized steel.
- I. Transfer Air and Sound Boots: 1/2 inch wg pressure class, fibrous glass.

2.02 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
 2. VOC Content: Not more than 250 g/L, excluding water.
 3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
- C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

2.03 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
- C. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- E. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
- F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- H. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

- A. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
 1. Manufacture in accordance with SMACNA (DCS).
- B. Round Ducts: Round lockseam duct with galvanized steel outer wall.
 1. Manufacture in accordance with SMACNA (DCS).
- C. Flexible Ducts: Two-ply vinyl film supported by helically wound spring steel wire.
 1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
 2. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
 3. Maximum Velocity: 4000 fpm.
 4. Temperature Range: Minus 10 degrees F to 160 degrees F.
- D. Acoustic Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
 1. Insulation: Fiberglass insulation with reinforced vapor barrier.
 2. Inner Core: Spun-bonded, non-woven inner core.
 3. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
 4. Maximum Velocity: 4000 fpm.
 5. Temperature Range: Minus 20 degrees F to 210 degrees F.

2.05 CASINGS AND PLENUMS

- A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

- B. Mount floor mounted casings on 4 inch high concrete curbs. At floor, rivet panels on 8 inch centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gauge, 0.0478 inch expanded metal mesh supported at 12 inch centers, turned up 12 inches at sides with sheet metal shields.
- C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- C. Flexible Ducts: Connect to metal ducts with draw bands.
- D. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Use double nuts and lock washers on threaded rod supports.
- G. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

END OF SECTION 233100

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**SECTION 233300
AIR DUCT ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Backdraft dampers - fabric.
- D. Combination fire and smoke dampers.
- E. Duct access doors.
- F. Duct test holes.
- G. Fire dampers.
- H. Flexible duct connectors.
- I. Smoke dampers.
- J. Smoke and fire-smoke damper test module.
- K. Volume control dampers.
- L. Miscellaneous products:
 - 1. Damper operators.
 - 2. Fire-rated enclosures.

1.02 REFERENCE STANDARDS

- A. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- C. NFPA 92 - Standard for Smoke Control Systems 2021, with Amendment.
- D. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 2021.
- E. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.
- F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.
- G. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.
- H. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances Current Edition, Including All Revisions.
- I. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.
- J. UL 555C - Standard for Safety Ceiling Dampers Current Edition, Including All Revisions.
- K. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

- A. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

2.02 BACKDRAFT DAMPERS - METAL

- A. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.03 BACKDRAFT DAMPERS - FABRIC

- A. Fabric Backdraft Dampers: Factory-fabricated.
 - 1. Blades: Neoprene coated fabric material.
 - 2. Birdscreen: 1/2 inch nominal mesh of galvanized steel or aluminum.
 - 3. Maximum Velocity: 1000 fpm (5 mps) face velocity.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- B. Provide factory sleeve and collar for each damper.
- C. Multiple Blade Dampers: Fabricate with 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.
- D. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.
- E. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

2.05 DUCT ACCESS DOORS

- A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
 - 1. Less Than 12 inches Square: Secure with sash locks.
 - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
 - 3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.
 - 4. Larger Sizes: Provide an additional hinge.
- B. Access doors with sheet metal screw fasteners are not acceptable.

2.06 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.07 FIRE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- B. Ceiling (Radiation) Dampers: Galvanized steel, 22 gauge, 0.0299 inch frame and 16 gauge, 0.0598 inch flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
 - 1. Rated for three hour service in compliance with UL 555C.
- C. Horizontal Dampers: Galvanized steel, 22 gauge, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

- D. Multiple Blade Dampers: 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- E. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

2.08 FLEXIBLE DUCT CONNECTORS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.

2.09 SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.
- B. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.
- C. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.10 SMOKE AND FIRE-SMOKE DAMPER TEST MODULE

- A. Addressable fire alarm system proprietary controller module preconfigured for remote testing of dedicated smoke damper or combination fire-smoke damper.
- B. Provide module, accessories, and connectivity to meet NFPA 80 and NFPA 105 requirements.

2.11 VOLUME CONTROL DAMPERS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Single Blade Dampers:
 - 1. Fabricate for duct sizes up to 6 by 30 inch.
 - 2. Blade: 24 gauge, 0.0239 inch, minimum.
- C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
 - 1. Blade: 18 gauge, 0.0478 inch, minimum.
- D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- E. Quadrants:
 - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
 - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
 - 3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct test holes where indicated and required for testing and balancing purposes.
- D. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

- E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- F. Demonstrate re-setting of fire dampers to Owner's representative.
- G. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

**SECTION 233423
HVAC POWER VENTILATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cabinet exhaust fans.
- B. Ceiling exhaust fans.
- C. Upblast roof exhausters.
- D. Inline centrifugal fans.

1.02 RELATED REQUIREMENTS

- A. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Section 230513 - Common Motor Requirements for HVAC Equipment.
- C. Section 230548 - Vibration and Seismic Controls for HVAC.
- D. Section 233300 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

- A. AMCA 99 - Standards Handbook 2016.
- B. AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance 2022, with Editorial Revision (2023).
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. UL 705 - Power Ventilators Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Submittals, for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Comply with AMCA 99.
- E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 ROOF EXHAUSTERS

- A. Manufacturers:
 - 1. Greenheck Fan Corporation: www.greenheck.com/#sle.
 - 2. Twin City Fan & Blower; BCRD: www.tcf.com/#sle.
- B. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.
- C. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

- D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch.
- E. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

2.03 CABINET AND CEILING EXHAUST FANS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
- C. Grille: Molded white plastic.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 INLINE CENTRIFUGAL FANS

- A. Manufacturers:
 - 1. Greenheck Fan Corporation: www.greenheck.com/#sle.
 - 2. Twin City Fan & Blower; BSI: www.tcf.com/#sle.
 - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Hung Cabinet Fans:
 - 1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 230548.
 - 2. Install flexible connections specified in Section 233300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- C. Provide sheaves required for final air balance.
- D. Install backdraft dampers on inlet to roof and wall exhausters.
- E. Provide backdraft dampers on outlet from cabinet and ceiling exhausters fans and as indicated.

END OF SECTION 233423

**SECTION 233700
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Diffusers:
- B. Rectangular ceiling diffusers.
- C. Slot ceiling diffusers.
- D. Registers/grilles:
 - 1. Ceiling-mounted, exhaust and return register/grilles.
 - 2. Ceiling-mounted, supply register/grilles.
 - 3. Wall-mounted, supply register/grilles.
 - 4. Wall-mounted, exhaust and return register/grilles.

1.02 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Krueger-HVAC: www.krueger-hvac.com/#sle.
- B. Price Industries: www.price-hvac.com/#sle.
- C. Ruskin Company: www.ruskin.com/#sle.
- D. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.
- E. Substitutions: See Section 016000 - Product Requirements.

2.02 RECTANGULAR CEILING DIFFUSERS

- A. Type: Provide rectangular and square formed adjustable, backpan stamped, core removable, and multi-louvered ceiling diffusers constructed to maintain 360 degree discharge air pattern with sectorizing baffles where indicated.
- B. Connections: Round.

2.03 CEILING SLOT DIFFUSERS

- A. Type: Continuous 3/4 inch wide slot, two slots wide, with adjustable vanes for left, right, or vertical discharge.
- B. Color: As indicated.
- C. Plenum: Integral, galvanized steel, insulated.

2.04 CEILING SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection.
- B. Color: As selected by Architect from manufacturer's standard range.

2.05 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical face.
- B. Color: To be selected by Architect from manufacturer's standard range.

2.06 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, vertical face, double deflection.
- B. Fabrication: Steel with 20 gauge, 0.0359 inch minimum frames and 22 gauge, 0.0299 inch minimum blades, steel and aluminum with 20 gauge, 0.0359 inch minimum frame, or aluminum extrusions, with factory baked enamel finish.
- C. Color: To be selected by Architect from manufacturer's standard range.

2.07 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with spring or other device to set blades, vertical face.
- B. Color: To be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

END OF SECTION 233700

**SECTION 237416
PACKAGED ROOFTOP AIR-CONDITIONING UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged, small-capacity, rooftop air-conditioning units.
- B. Packaged, intermediate-capacity, rooftop air-conditioning units.

1.02 REFERENCE STANDARDS

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements for additional provisions.
 - 2. Extra Filters: One set for each unit.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

- A. Manufacturers:
 - 1. Carrier Corporation: www.commercial.carrier.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. General: Roof mounted units having gas burner and electric refrigeration that are 6 tons and smaller in capacity.
- C. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.
- D. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.02 PACKAGED, INTERMEDIATE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

- A. Manufacturers:
 - 1. Carrier Corporation: www.commercial.carrier.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.

- B. General: Roof mounted units having gas burner and electric refrigeration that are 7.5 tons to 25 tons in capacity.
- C. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.
- D. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.03 CASING

- A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver-operated flush, cam type fasteners. Structural members to be minimum 18 gauge, 0.0478 inch, with access doors or panels of minimum 20 gauge, 0.0359 inch.

2.04 FANS

2.05 BURNERS

- A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame-sensing device, and automatic 100 percent shutoff pilot.
- B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.

2.06 EVAPORATOR COIL

- A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.
- B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.07 CONDENSER COIL

- A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.
- B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.

2.08 COMPRESSORS

- A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

2.09 AIR FILTERS:

- A. 2-inch thick, glass fiber disposable media in metal frames.

2.10 OPERATING CONTROLS - SINGLE ZONE UNITS

- A. Electric solid state microcomputer-based room thermostat, located as indicated in service area with remote sensor located as indicated in service area with remote sensor.
- B. Room thermostat to incorporate:
 - 1. Automatic switching from heating to cooling.
 - 2. Preferential rate control to minimize overshoot and deviation from setpoint.
 - 3. Set up for four separate temperatures per day.
 - 4. Short cycle protection.
- C. Room thermostat display to include:
 - 1. Actual room temperature.
 - 2. Programmed temperature.
 - 3. Programmed time.
 - 4. Time of day.

5. Day of week.
6. System model indication: heating, cooling, auto, off, fan auto, fan on.
7. Stage heating or cooling operation.

2.11 ROOF CURBS

- A. Roof Mounting Curb: 14 inches high, galvanized steel, channel frame with gaskets, nailer strips.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that roof is ready to receive work and opening dimensions are as required by manufacturer.
- B. Verify that proper power supply is available.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 SYSTEM STARTUP

- A. Prepare and start equipment. Adjust for proper operation.

END OF SECTION 237416

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**SECTION 237433
DEDICATED OUTDOOR AIR UNITS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Roof-mounted DOAS.

1.02 REFERENCE STANDARDS

- A. AHRI 520 - Performance Rating of Positive Displacement Condensing Units 2004.
- B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data with dimensions, duct and service connections, accessories, controls, electrical nameplate data, and wiring diagrams.
- C. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- D. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. All models shall be ETL listed and comply to safety standards UL 1995, the Standard for Safety for Heating and Cooling Equipment. The Engineer of Record shall take responsibility for the approval of any modifications or additions to the unit, including aftermarket UV or ionization filtration devices.
- C. All models shall be ETL listed and comply to safety standards CSA Std. C22.2, No. 236-11.
- D. Units outfitted with indirect fired heaters shall also comply with ANSI Z83.8-2013, and CSA 2.6-2013.
- E. This unit has been tested in accordance to the following standards:
 - 1. ANSI/AHRI Standard 340/360
 - 2. ANSI/ASHRAE Standard 37
 - 3. AHRI Standard 270/370

1.05 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. 10-Year (non-prorated) parts warranty covering the entire unit when accompanied by a company provided service plan. 5-Year (non-prorated) parts warranty covering the entire unit otherwise.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Daikin.

2.02 ROOF-MOUNTED DOAS FABRICATION REQUIREMENTS

- A. Heating Section:
 - 1. Indirect Gas-Fired Furnace:
 - a. Fully sealed natural gas burning assembly configured for modulated 5:1 turn down ratio using electrically operated devices including modulating main gas valve, shut down valve, main gas, and pilot gas regulators. Manual main gas shut-off valve and pilot adjustment valve.
 - b. Insulation: Neoprene faced glass fiber insulation, 1 inch thick, on inlet components to burner profile plate.

- c. Observation Port: On burner section for observing main and pilot flames.
 - d. Pilot: Electrically ignited by spark rod through high voltage ignition transformer.
 - e. Damper: Motorized with end switch to prove position before burner will fire.
- B. Cooling Section:
- 1. Packaged DX Cooling:
 - a. Configuration: AHRI 520 rated, R-410a refrigerant system with hot gas bypass.
 - b. Evaporator Coil: Indoor coil shall be a high efficiency 4-10 row coil design with aluminum fins mechanically bonded to copper tubes. Coil is staggered to increase turbulence, reduce the coil bypass factor, and ultimately increase the time the air stays within the coil. Includes two probe sensors to read average coil face temperature.
 - c. Electronic Expansion Valve: Each refrigeration circuit will be outfitted with an electronic expansion valve metering device which can be throttled from 0-100% open to allow for precise superheat control.
 - d. Indoor Coil Drain Pan: The indoor coil shall be outfitted with a sloped stainless steel drain pan. This pan shall be insulated along the entire base to prevent condensation, and outfitted with a safety overflow switch which will automatically shut down cooling operation prior to water overflowing the drain pan in the event of a drain clog. The entire drain pan shall be 20 GA Stainless Steel construction and wrap beneath the entire coil with flashing on entering side of coil to ensure capture of all condensate. Drain pan discharge pipe shall also be stainless steel construction. Drain pan shall be pitched to exceed ASHRAE 62.1 standard.
 - e. Compressor: Unit shall utilize a variable speed inverter duty scroll compressor with the following:
 - 1) Modulation: Compressor shall be capable of compressor speed modulation from 15%-100% on 5, 6, 7.5, 8, 10, & 12.5 Ton units. Compressor shall be capable of compressor speed modulation from 25%-100% on 15, 20, 22, 25, 30, 40, and 50 Ton units.
 - 2) Vibration Isolation: Compressor as well as blower assembly shall each be mounted on rubber vibration isolators to reduce transmission of vibration to the building structure.
 - 3) Internal Overload Protection: Compressor shall include internal thermal overload protection to protect against excessive motor temperatures.
 - 4) Crankcase Heater: Compressor shall include a crankcase heater to protect against liquid flood-back and elimination of oil foaming on startup. The crankcase heater must remain powered when the compressor is not in operation.
 - 5) Oil Management: Unit shall utilize both passive and active oil return management using Oil Level Sensor and scheduled oil boosts.
 - 6) Monitored Envelope: Unit shall monitor all critical refrigeration points to ensure compressor does not operate outside of safe operating envelope.
 - 7) Throttling Logic: Unit shall allow for high head pressure monitoring throttle mode for high ambient operation, and low suction pressure throttle mode for low capacity operation or any conditions resulting in low suction pressure.
 - 8) Pump-Down: Active pump-down mode with discharge line check valve to protect against liquid migration into compressor during idle times.
 - f. Outdoor (Condenser) Coil: Outdoor coil shall be a high efficiency coil design with aluminum fins mechanically bonded to copper tubes. The coil shall be downward sloped to protect coil from hail damage. Optional hail guards may also be outfitted to the outdoor coil for added protection from hail bouncing off the unit's roof up the coil.
 - g. Outdoor Fans: The outdoor coil shall have a vertical discharge outfitted with quiet, efficient, fully modulating Electronically Commutated Motor (ECM) condensing fans. These fans shall modulate to maintain a temperature differential between outside air and the outdoor coil.

- h. Base of the condensing coil cabinet shall be pitched away from the unit as a safety to ensure all draining exits away from the curb.
- i. Hot Gas Reheat Coil: The unit shall include an optional copper tube and aluminum fin hot gas reheat coil mounted downstream of the indoor coil. This coil shall be controlled via fully modulating hot gas reheat valve to provide precise reheat temperature control. This coil shall include the addition of an evaporative coil leaving condition sensor to maintain a coil dew point. This also prevents operation of a dehumidification call when intake dew point conditions are found to be below space dew point conditions, preventing wasted energy.
- j. Operating and Safety Controls: Internally coordinated with main unit controls.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide unit- or duct-mounted smoke detectors and other NFPA 90A provisions.
- C. Provide flexible duct connections on outlet from unit; see 233100 - HVAC Ducts and Casings.
- D. Connect drain pan outlet to nearest building drain system piping.
- E. Adjusting: Use plenum static pressure readings against manufacturer calibration chart to adjust primary airflow as other measuring methods will not work.
- F. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote software app or terminal; see Section 253500.

END OF SECTION 237433

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SECTION 238126.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Air cooled condensing units.
- C. Indoor air handling (fan and coil) units for ductless systems.
- D. Controls.

1.02 RELATED REQUIREMENTS

- A. Section 230913 - Instrumentation and Control Devices for HVAC: Thermostats, humidistats, time clocks.

1.03 REFERENCE STANDARDS

- A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.
- B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units 2004.
- C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.
- D. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant 2019.
- E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
- F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2021.
- G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000-Administrative Requirements for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Design Data: Indicate refrigerant pipe sizing.
- E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
- F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- H. Project Record Documents: Record actual locations of components and connections.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience and approved by manufacturer.

1.06 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year manufacturers warranty for solid state ignition modules.
- C. Provide five year manufacturers warranty for condensing units and compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Trane Mitsubishi Inc: www.trane.com/#sle.

2.02 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
 - 1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
 - 2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements: See Drawings for additional requirements.
- C. Electrical Characteristics:
 - 1. See drawings for additional requirements.

2.03 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
 - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
 - 2. Manufacturer: System manufacturer.

2.04 OUTDOOR UNITS

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
 - 1. Comply with AHRI 210/240.
 - 2. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
 - 3. Refrigerant: R-410A.
 - 4. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.
- B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
- C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
 - 1. Provide thermostatic expansion valves.
- D. Operating Controls:
 - 1. Control by room thermostat to maintain room temperature setting.

2.05 ACCESSORY EQUIPMENT

- A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
 - 1. Automatic switching from heating to cooling.
 - 2. Preferential rate control to minimize overshoot and deviation from setpoint.

3. Thermostat Display:
 - a. Actual room temperature.
 - b. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.

3.02 INSTALLATION

- A. Install thermostats and temperature sensors at 48" above finished floor.
- B. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- C. Install in accordance with NFPA 90A and NFPA 90B.

END OF SECTION 238126.13

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SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single conductor building wire.
- B. Metal-clad cable.
- C. Wiring connectors.
- D. Electrical tape.
- E. Heat shrink tubing.
- F. Oxide inhibiting compound.
- G. Wire pulling lubricant.
- H. Cable ties.
- I. Firestop sleeves.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2020.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- H. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable 2018.
- I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.
- J. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- M. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- N. UL 267 - Outline of Investigation for Wire-Pulling Compounds Current Edition, Including All Revisions.
- O. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- P. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.

- Q. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.
- S. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Metal-clad cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
 - 1) Maximum Length: 6 feet.
 - b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
 - 1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
 - 2. In addition to other applicable restrictions, may not be used:
 - a. Unless approved by Owner.
 - b. Where not approved for use by the authority having jurisdiction.
 - c. Where exposed to view.
 - d. Where exposed to damage.
 - e. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- H. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
 - 2. Control Circuits: 14 AWG.
- I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- J. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Description: Single conductor insulated wire.
- B. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
- C. Insulation Voltage Rating: 600 V.

- D. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground: Type XHHW-2.

2.04 METAL-CLAD CABLE

- A. Manufacturers:
 - 1. AFC Cable Systems Inc: www.afcweb.com/#sle.
 - 2. Encore Wire Corporation: www.encorewire.com/#sle.
 - 3. Service Wire Co: www.servicewire.com/#sle.
 - 4. Southwire Company: www.southwire.com/#sle.
- B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
- C. Conductor Stranding:
 - 1. Size 10 AWG and Smaller: Solid.
 - 2. Size 8 AWG and Larger: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.
- F. Grounding: Full-size integral equipment grounding conductor.
- G. Armor: Steel, interlocked tape.
- H. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 260526.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 - 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
 - 6. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.06 ACCESSORIES

- A. Electrical Tape:
 - 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 - 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
 - 3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
 - 4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
 - 5. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
 - 6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- D. Wire Pulling Lubricant:
 - 1. Listed and labeled as complying with UL 267.
 - 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 - 3. Suitable for use at installation temperature.
- E. Cable Ties: Material and tensile strength rating suitable for application.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.

- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated without specific routing, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:
 - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
 - b. Increase size of conductors as required to account for ampacity derating.
 - c. Size raceways, boxes, etc. to accommodate conductors.
 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install metal-clad cable (Type MC) in accordance with NECA 120.
- E. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- H. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):

- a. Use listed fittings.
 - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- I. Install conductors with a minimum of 12 inches of slack at each outlet.
 - J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
 - K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
 - L. Make wiring connections using specified wiring connectors.
 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
 - M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
 - b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
 - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
 3. Wet Locations: Use heat shrink tubing.
 - N. Insulate ends of spare conductors using vinyl insulating electrical tape.
 - O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
 - P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
 - Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.

- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
 - 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 260519

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

1.02 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 260536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 265600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2022.
- C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 - 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 - 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 - 5. Ground Rod Electrode(s):
 - a. Provide single electrode unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
 - 6. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
 - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- E. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- F. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
 - c. Generators, when neutral is switched in the transfer switch.
 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 4. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
 5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
 8. Provide bonding for interior metal air ducts.
 9. Provide bonding for metal building frame.
- H. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
 2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
 - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
 - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
 - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- I. Cable Tray Systems: Also comply with Section 260536.
- J. Pole-Mounted Luminaires: Also comply with Section 265600.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
- D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 2. Size: As indicated.
 3. Holes for Connections: As indicated or as required for connections to be made.
- E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
 2. Material: Copper-bonded (copper-clad) steel.
 3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).

- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
 - 1. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.
- D. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION 260526

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**SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
 - 2. Coordinate work to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
 - 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
 - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 033000.

1.05 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. NFPA 70.
 - b. Requirements of authorities having jurisdiction.
 - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.

3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 4. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
 1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
- D. Metal Channel/Strut Framing Systems:
 1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 2. Comply with MFMA-4.
- E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
 1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

- 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners in accordance with manufacturer's recommended torque settings.
- I. Remove temporary supports.
- J. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 260529

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SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. PVC-coated galvanized steel rigid metal conduit (RMC).
- C. Flexible metal conduit (FMC).
- D. Liquidtight flexible metal conduit (LFMC).
- E. Galvanized steel electrical metallic tubing (EMT).
- F. Rigid polyvinyl chloride (PVC) conduit.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 078400 - Firestopping.
- C. Section 260526 - Grounding and Bonding for Electrical Systems.
- D. Section 260529 - Hangers and Supports for Electrical Systems.
- E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
- E. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- G. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- L. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- M. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- N. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.
- O. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- Q. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- R. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
 - 5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit, galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
 - 4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) or schedule 80 rigid PVC conduit where emerging from underground.
 - 5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, PVC-coated galvanized steel rigid metal conduit (RMC) elbows, or concrete-encased PVC elbows for bends.
 - 6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.

7. Where galvanized steel electrical metallic tubing (EMT) is installed in direct contact with earth, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
 8. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.
- D. Embedded Within Concrete:
1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.
 2. Within Slab Above Ground: Use galvanized steel rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.
 3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit (RMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit.
 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT) where emerging from concrete.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT).
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel electrical metallic tubing (EMT).
1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
- K. Flexible Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit (FMC).
 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
 3. Maximum Length: 6 feet unless otherwise indicated.
 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- C. Provide products listed, classified, and labeled as suitable for purpose intended.

- D. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4-inch trade size.
 - 2. Underground, Interior: 1-inch trade size.
 - 3. Underground, Exterior: 1-inch trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 - 2. Material: Use steel or malleable iron.
 - 3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.
- C. PVC-Coated Boxes and Fittings:
 - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 - 2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
 - 3. Material: Use steel or malleable iron.
 - 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.05 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 2. Material: Use steel or malleable iron.

2.07 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- B. Fittings:
 - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.
4. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.
 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.
- E. Conduit Mechanical Seals:
 1. Listed as complying with UL 514B.
 2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
 3. Suitable for sealing around conductors/cables to be installed.
- F. Sealing Systems for Concrete Penetrations:
 1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
 2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
- G. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- H. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
- I. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Install conduit in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 - 5. Unless otherwise approved, do not route exposed conduits:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - 6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
 - 9. Arrange conduit to provide no more than 150 feet between pull points.
 - 10. Route conduits above water and drain piping where possible.
 - 11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
 - 13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - 14. Group parallel conduits in same area on common rack.
- H. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 - 4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 - 5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 - 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.

7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
 8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
 9. Use of spring steel conduit clips for support of conduits is not permitted.
 10. Use of wire for support of conduits is not permitted.
 11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
- I. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
 7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
 8. Secure joints and connections to provide mechanical strength and electrical continuity.
- J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
 9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.
- K. Underground Installation:
1. Provide trenching and backfilling; see Idaho Standards for Public Works Construction, Division 300.
 2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 18 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 260553.
- L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Secure conduits to prevent floating or movement during pouring of concrete.

- M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 033000.
- N. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
 - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 - 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 - 3. Where conduits are subject to earth movement by settlement or frost.
- O. Conduit Sealing:
 - 1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
 - a. Where conduits enter building from outside.
 - b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.
 - 2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
 - a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- P. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- Q. Provide grounding and bonding; see Section 260526.
- R. Identify conduits; see Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 260533.13

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Boxes and enclosures for integrated power, data, and audio/video.
- D. Floor boxes.
- E. Underground boxes/enclosures.
- F. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete.
- B. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 262726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Floor box service fittings.
 - 3. Additional requirements for locating boxes for wiring devices.
- F. Section 271000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. SCTE 77 - Specifications for Underground Enclosure Integrity 2017.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- J. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
- K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
 - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 - 3. Use suitable concrete type boxes where flush-mounted in concrete.
 - 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 6. Use shallow boxes where required by the type of wall construction.
 - 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 12. Wall Plates: Comply with Section 262726.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 - b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
 4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
 5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
- E. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
 2. Use cast iron floor boxes within slab on grade.
 3. Use sheet-steel or cast iron floor boxes within slab above grade.
 4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
 5. Manufacturer: Same as manufacturer of floor box service fittings.
- F. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
 2. Size: As indicated on drawings.
 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
 4. Applications:
 - a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
 - b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
 - c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
 5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
 - a. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

2.02 ACCESSORIES

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
 - b. Communications Systems Outlets: Comply with Section 271000.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 7. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 - 8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
 - 9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
 - 10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.

- b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- I. Box Supports:
- 1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 - 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
- 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
- M. Install boxes as required to preserve insulation integrity.
- N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- P. Underground Boxes/Enclosures:
- 1. Install enclosure on gravel base, minimum 6 inches deep.
 - 2. Flush-mount enclosures located in concrete or paved areas.
 - 3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
 - 4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
- Q. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- S. Close unused box openings.
- T. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- U. Provide grounding and bonding in accordance with Section 260526.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 260533.16

**SECTION 260536
CABLE TRAYS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Metal cable tray systems:
 - 1. Metal ladder cable tray.
 - 2. Metal wire mesh/basket cable tray.

1.02 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- B. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2023.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NEMA VE 1 - Metal Cable Tray Systems 2017.
- E. NEMA VE 2 - Cable Tray Installation Guidelines 2018.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within cable tray required clearances.
 - 2. Coordinate arrangement of cable tray with the dimensions and clearance requirements of the actual products to be installed.
 - 3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 4. Notify of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.
- C. Sequencing:
 - 1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.

- C. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA VE 2, except do not store cable tray outdoors without cover as permitted in NEMA VE 2.
- B. Handle products carefully to avoid damage to finish.

PART 2 PRODUCTS

2.01 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

- A. Provide new cable tray system consisting of all required components, fittings, supports, accessories, etc. as necessary for a complete system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.
- D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under the service conditions at the installed location.
- E. Unless otherwise indicated, specified span/load ratings are based on safety factor of 1.5 and working load only (no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA VE 1.
- F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA VE 1 including applicable allowable tolerances.

2.02 METAL CABLE TRAY SYSTEMS

- A. Comply with NEMA VE 1.
- B. Finishes:
 - 1. Zinc Electroplated Steel: Comply with ASTM B633.
 - 2. Mill-Galvanized Before Fabrication (Pre-Galvanized) Steel: Comply with ASTM A653/A653M, G90 coating.
- C. Metal Ladder Cable Tray:
 - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
 - 2. Load/Fill Depth: As indicated on drawings.
 - 3. Span/Load Rating: As indicated on drawings.
 - 4. Rung Spacing: 9 inches on center for straight lengths.
 - 5. Inside Width: As indicated on drawings.
 - 6. Inside Radius of Fittings: 12 inches.
- D. Metal Wire Mesh/Basket Cable Tray:

1. Material: Zinc electroplated steel or mill-galvanized before fabrication (pre-galvanized) steel.
2. Tray Depth: As indicated on drawings.
3. Span/Load Rating: As indicated on drawings.
4. Mesh Spacing: 2 by 4 inches.
5. Tray Width: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage cable tray system has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that the dimensions and span/load ratings of cable tray system components are consistent with the indicated requirements.
- D. Verify that mounting surfaces are ready to receive cable tray and associated supports.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install cable tray in accordance with NECA 1 (general workmanship), and NEMA VE 2.
- C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.
- D. Arrange cable tray to provide required clearances and maintain cable access.
 1. Minimum Clearance Above and Adjacent to Cable Tray: 12 inches.
- E. Install cable tray plumb and level, with sections aligned and with horizontal runs at the proper elevation.
- F. Metal Wire Mesh/Basket Cable Tray: Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.
 1. Inside Radius of Fittings: 12 inches.
- G. Cable Tray Movement Provisions:
 1. Provide suitable expansion fittings where cable tray is subject to movement, including but not limited to:
 - a. Where cable tray crosses structural joints intended for expansion.
 - b. Long straight cable tray runs in accordance with NEMA VE 2.
 2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA VE 2.
 3. Set gaps for expansion fittings in accordance with NEMA VE 2.
- H. Cable Provisions:
 1. Use suitable fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
 2. Use suitable drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
 3. Use suitable cable support fittings for long vertical cable tray runs with heavy cables.
- I. Provide end closures at unconnected ends of cable tray runs.
- J. Cable Tray Support:
 1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA VE 2 and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and attachment in accordance with Section 260529, where not furnished by cable tray manufacturer.
 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- K. Grounding and Bonding Requirements, in Addition to Requirements of Section 260526:
 1. Comply with grounding and bonding requirements of NEMA VE 2.

2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified connectors to provide electrical continuity.
- L. Conduit Termination:
 1. Use listed cable tray conduit clamps (evaluated for bonding connection) to terminate conduits at cable tray.
 2. Provide insulating bushing at conduit termination to protect cables.
 3. Provide independent support for conduit.
- M. Cable Installation:
 1. Comply with cable installation requirements of NEMA VE 2.
 2. Use appropriate cable pulling tools, applied to prevent excessive force on cable tray system and maintain minimum cable bending radius.
 3. Use cable clamps or cable ties to fasten conductors/cables to vertical and horizontal runs of cable tray.
 - a. Distance Between Fastening Points for Vertical Runs: 18 inches.
 - b. Distance Between Fastening Points for Horizontal Runs: As required to maintain spacing and confine conductor/cable within the cable fill area.
- N. Penetrations: Install firestopping to preserve fire resistance rating of building elements, using materials and methods specified in Section 078400.
- O. Identification Requirements, in Addition to Those Specified in Section 260553.
- P. Install cable tray covers where indicated and as follows:

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect cable tray system for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective cable tray system components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Remove dirt and debris from cable tray.
- B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 PROTECTION

- A. Protect cable tray system from subsequent construction operations.

END OF SECTION 260536

**SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Voltage markers.
- D. Underground warning tape.
- E. Floor marking tape.
- F. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Section 099113 - Exterior Painting.
- B. Section 099123 - Interior Painting.
- C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 260536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
- E. Section 260573 - Power System Studies: Arc flash hazard warning labels.
- F. Section 262726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.
- G. Section 271000 - Structured Cabling: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchboards:

- 1) Identify ampere rating.
- 2) Identify voltage and phase.
- 3) Identify power source and circuit number. Include location when not within sight of equipment.
- 4) Use identification nameplate to identify main overcurrent protective device.
- 5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
- b. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
- c. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify load(s) served. Include location when not within sight of equipment.
- d. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
- e. Centralized Emergency Lighting Inverters:
 - 1) Identify input and output voltage and phase.
 - 2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location.
- f. Transfer Switches:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - 4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.
2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
 - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
4. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
5. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.

- a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 099123 and 099113.
6. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
7. Arc Flash Hazard Warning Labels: Comply with Section 260573.
8. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
9. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- B. Identification for Conductors and Cables:
 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
- C. Identification for Cable Tray: Comply with Section 260536.
- D. Identification for Boxes:
 1. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
 - a. For exposed boxes in public areas, use only identification labels.
- E. Identification for Devices:
 1. Identification for Communications Devices: Comply with Section 271000.
 2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
 3. Use identification label to identify fire alarm system devices.
 - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
 4. Use identification label to identify serving branch circuit for all receptacles.
 - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
- F. Identification for Luminaires:
 1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend:
 - a. System designation where applicable:
 - 1) Emergency Power System: Identify with text "EMERGENCY".
 - 2) Fire Alarm System: Identify with text "FIRE ALARM".
 - b. Equipment designation or other approved description.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. System Designation: 1 inch.
 - b. Equipment Designation: 1/2 inch.
 - c. Other Information: 1/4 inch.
 - d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
 5. Color:
 - a. Normal Power System: White text on black background.
 - b. Fire Alarm System: White text on red background.
- D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/4 inch.
 5. Color: Black text on white background unless otherwise indicated.
- E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/2 inch.
 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Power source and circuit number or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Black text on clear background.
- G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Load controlled or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.

5. Color: Black text on clear background.
- H. Format for Fire Alarm Device Identification:
 1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Designation indicated and device zone or address.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Red text on white background.

2.03 VOLTAGE MARKERS

- A. Manufacturers:
- B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- D. Minimum Size:
- E. Legend:
 1. Markers for Voltage Identification: Highest voltage present.
 2. Markers for System Identification:
 - a. Emergency Power System: Text "EMERGENCY".
- F. Color: Black text on orange background unless otherwise indicated.

2.04 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:

2.05 FLOOR MARKING TAPE

- A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

2.06 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - a. Do not use labels designed to be completed using handwritten text.
 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 - 1. Surface-Mounted Equipment: Enclosure front.
 - 2. Flush-Mounted Equipment: Inside of equipment door.
 - 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 - 4. Elevated Equipment: Legible from the floor or working platform.
 - 5. Branch Devices: Adjacent to device.
 - 6. Interior Components: Legible from the point of access.
 - 7. Boxes: Outside face of cover.
 - 8. Conductors and Cables: Legible from the point of access.
 - 9. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 260553

**SECTION 260573
POWER SYSTEM STUDIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Short-circuit study.
- B. Arc flash and shock risk assessment.
 - 1. Includes arc flash hazard warning labels.
- C. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

- A. Section 260553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).
- B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis 1997.
- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems 2006.
- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations 2018, with Errata (2019).
- G. NEMA MG 1 - Motors and Generators 2021.
- H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 70E - Standard for Electrical Safety in the Workplace 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Submit study reports prior to or concurrent with product submittals.
 - 2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Study preparer's qualifications.
- C. Study reports, stamped or sealed and signed by study preparer.

- D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
 - 1. Identify modifications made in accordance with studies that:
 - a. Can be made at no additional cost to Owner.
 - b. As submitted will involve a change to the contract sum.
- E. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

1.06 POWER SYSTEM STUDIES

- A. Scope of Studies:
 - 1. Perform analysis of new electrical distribution system as indicated on drawings.
 - 2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
 - 3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
 - a. Known Operating Modes:
 - 1) Utility as source.
 - 2) Generator as source.
- B. General Study Requirements:
 - 1. Comply with NFPA 70.
 - 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:
 - 1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
 - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
 - 1) Obtain up-to-date information from Utility Company.
 - 2) Utility Company: As indicated on drawings.
 - b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
 - c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
 - d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
 - e. Protective Devices:
 - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
 - 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
 - f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
 - g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
- D. Short-Circuit Study:
 - 1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
 - a. Maximum utility fault currents.
 - b. Maximum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
 2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
 - a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
 3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
 4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
 - a. Maximum and minimum utility fault currents.
 - b. Maximum and minimum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
- F. Study Reports:
1. General Requirements:
 - a. Identify date of study and study preparer.
 - b. Identify study methodology and software product(s) used.
 - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
 - d. Identify base used for per unit values.
 - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
 - f. Include conclusions and recommendations.
 2. Short-Circuit Study:
 - a. For each scenario, identify at each bus location:
 - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
 - 2) Fault point X/R ratio.
 - 3) Associated equipment short circuit current ratings.
 - b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
 3. Arc Flash and Shock Risk Assessment:
 - a. For the worst case for each scenario, identify at each bus location:
 - 1) Calculated incident energy and associated working distance.
 - 2) Calculated arc flash boundary.
 - 3) Bolted fault current.
 - 4) Arcing fault current.
 - 5) Clearing time.
 - 6) Arc gap distance.
 - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.07 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in Idaho and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.
 - 1. Study preparer may be employed by manufacturer of electrical distribution equipment.
- B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
 - 1. Products:
 - a. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
 - 1. Materials: Comply with Section 260553.
 - 2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
 - a. Include the following information:
 - 1) Arc flash boundary.
 - 2) Available incident energy and corresponding working distance.
 - 3) Nominal system voltage.

PART 3 EXECUTION

3.01 INSTALLATION

3.02 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Adjust equipment and protective devices for compliance with studies and recommended settings.
- D. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

3.03 CLOSEOUT ACTIVITIES

- A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
 - 1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of four hours of training.
 - 3. Instructor: Representative of entity performing study.
 - 4. Location: At project site.

END OF SECTION 260573

**SECTION 260583
WIRING CONNECTIONS**

PART 2 PRODUCTS

1.01 MATERIALS

- A. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.
- B. Wiring Devices: As specified in Section 262726.
- C. Flexible Conduit: As specified in Section 260533.13.
- D. Wire and Cable: As specified in Section 260519.
- E. Boxes: As specified in Section 260533.16.

1.02 EQUIPMENT CONNECTIONS

PART 3 EXECUTION

2.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

2.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 260583

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**SECTION 260923
LIGHTING CONTROL DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Occupancy sensors.
- B. Daylighting controls.

1.02 RELATED REQUIREMENTS

- A. Section 260529 - Hangers and Supports for Electrical Systems
- B. Section 260533.16 - Boxes for Electrical Systems.
- C. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
 - 1. Includes finish requirements for wall controls specified in this section.

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices current edition.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
 - 3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
 - 4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
 - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:
 - 1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
- C. Field Quality Control Reports.
- D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Operation and Maintenance Data: Include detailed information on device programming and setup.

- F. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

- A. All Occupancy Sensors:
 - 1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
 - 2. Sensor Technology:
 - a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
 - 3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
 - 4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
 - 5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
 - 6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
 - 7. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
 - 8. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
 - 9. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.
 - 10. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
 - 11. Wireless Sensors:
 - a. RF Range: 30 feet through typical construction materials.

- b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits:
Comply with FCC requirements of 47 CFR 15, for Class B application.
- c. Power: Battery-operated with minimum ten-year battery life.
- B. Wall Switch Occupancy Sensors:
 - 1. All Wall Switch Occupancy Sensors:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
 - b. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
 - c. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.
 - C. Wall Dimmer Occupancy Sensors:
 - 1. General Requirements:
 - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.
 - b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
 - c. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
 - d. Provide field adjustable dimming preset for occupied state.
 - e. Finish: Match finishes specified for wiring devices in Section 262726, unless otherwise indicated.
 - D. Ceiling Mounted Occupancy Sensors:
 - 1. All Ceiling Mounted Occupancy Sensors:
 - a. Description: Low profile occupancy sensors designed for ceiling installation.
 - b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
 - c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
 - d. Finish: White unless otherwise indicated.
 - 2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - 3. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
 - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
 - b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet.
 - E. Power Packs for Low Voltage Occupancy Sensors:
 - 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
 - 2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
 - 3. Input Supply Voltage: Dual rated for 120/277 V ac.
 - F. Power Packs for Wireless Occupancy Sensors:

1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.
2. Input Supply Voltage: Dual rated for 120/277 V ac.

G. Accessories:

2.03 DAYLIGHTING CONTROLS

- A. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.
- B. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
 1. Sensor Type: Filtered silicon photo diode.
 2. Sensor Range:
 - a. Indoor Photo Sensors: 5 to 100 footcandles.
 - b. Outdoor Photo Sensors: 5 to 250 footcandles.
 3. Finish: White unless otherwise indicated.
- C. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.
- D. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
 1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
 2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
 3. Control Capability:

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
 - 1. Mounting Heights: As indicated on the drawings.
 - 2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.
- G. Provide required supports in accordance with Section 260529.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Occupancy Sensor Locations:
 - 1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
 - 2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
- J. Outdoor Photo Control Locations:
 - 1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
 - 2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
- K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
- L. Daylighting Control Photo Sensor Locations:
 - 1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.
 - 2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
 - 3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
- M. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each lighting control device for damage and defects.

- C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- D. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- E. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
- C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- D. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

- A. See Section 019113 - General Commissioning Requirements for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
 - 4. Location: At project site.

END OF SECTION 260923

**SECTION 262100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code(R) (NEC(R)) 2023.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. IEEE C2 (National Electrical Safety Code).
 - 2. NFPA 70 (National Electrical Code).
 - 3. The requirements of the Utility Company.

PART 2 PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics: As indicated on drawings.
- C. Division of Responsibility: As indicated on drawings.
- D. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required trenching and backfilling in accordance with Idaho Standards for Public Works Construction Division 300.
- E. Provide required support and attachment components in accordance with Section 260529.

- F. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.
- G. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

3.03 PROTECTION

- A. Protect installed equipment from subsequent construction operations.

END OF SECTION 262100

SECTION 262200
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General purpose transformers.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.13 - Conduit for Electrical Systems: Flexible conduit connections.

1.03 REFERENCE STANDARDS

- A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers Current Edition.
- B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers 2015.
- C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers 2013.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers 2015.
- F. NEMA ST 20 - Dry Type Transformers for General Applications 2021.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 506 - Standard for Specialty Transformers Current Edition, Including All Revisions.
- J. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
- C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Maintenance Data: Include recommended maintenance procedures and intervals.
- F. Project Record Documents: Record actual locations of transformers.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 TRANSFORMERS - GENERAL REQUIREMENTS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
 - 1. Altitude: Less than 3,300 feet.
 - 2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104 degrees F.
 - b. Less than 10 kVA: Not exceeding 77 degrees F.
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.
- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.02 GENERAL PURPOSE TRANSFORMERS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Primary Voltage: 480 volts delta, 3 phase.

- C. Secondary Voltage: 208Y/120 volts, 3 phase.
- D. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
 - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.
- E. Coil Conductors: Continuous aluminum windings with terminations brazed or welded.
- F. Winding Taps:
 - 1. Less than 3 kVA: None.
 - 2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
 - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
 - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
- H. Sound Levels: Standard sound levels complying with NEMA ST 20
- I. Mounting Provisions:
 - 1. Less than 15 kVA: Suitable for wall mounting.
 - 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
 - 3. Larger than 75 kVA: Suitable for floor mounting.
- J. Transformer Enclosure: Comply with NEMA ST 20.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 2.
 - 2. Construction: Steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.
- K. Accessories:
 - 1. Mounting Brackets: Provide manufacturer's standard brackets.
 - 2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 260533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Install transformers plumb and level.
- G. Transformer Support:
 - 1. Provide required support and attachment in accordance with Section 260529, where not furnished by transformer manufacturer.
 - 2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
 - 3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
 - 4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.

3.04 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262200

SECTION 262413 SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.
- E. Section 262813 - Fuses: Fuses for fusible switches.
- F. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e, with Amendment (2017).
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 400 - Standard for Installing and Maintaining Switchboards 2007.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- G. NEMA PB 2 - Deadfront Distribution Switchboards 2011.
- H. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less 2013.
- I. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- J. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- M. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- N. UL 891 - Switchboards Current Edition, Including All Revisions.
- O. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:
1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
 2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
 3. Obtain Utility Company approval of switchboard prior to fabrication.
 4. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
- D. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.
- E. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
 2. Enclosure Keys: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Front-Connected Switchboards:
1. Main Device(s): Individually-mounted.
 2. Feeder Devices: Panel/group-mounted.
 3. Arrangement: Front accessible only (not rear accessible), rear aligned.
 4. Gutter Access: Bolted covers.
- E. Service Entrance Switchboards:
1. Listed and labeled as suitable for use as service equipment according to UL 869A.
 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
 3. Comply with Utility Company requirements for electrical service.
 4. Utility Metering Provisions: Provide separate barriered compartment complying with Utility Company requirements where indicated or where required by Utility Company. Include hinged sealable door and provisions for Utility Company current transformers (CTs), potential transformers (PTs), or potential taps as required.
- F. Service Conditions:
1. Provide switchboards and associated components suitable for operation under the conditions at the installation location.
- G. Short Circuit Current Rating:
1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
 2. Minimum Rating: 65,000 rms symmetrical amperes.
- H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 2. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 3. Phase and Neutral Bus Material: Aluminum.
 4. Ground Bus Material: Aluminum.
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
 2. Load Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Lug Type:

- K. Enclosures:
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
 - 2. Finish: Manufacturer's standard unless otherwise indicated.
- L. Future Provisions:
 - 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- M. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchboards as a complete assembly including surge protective device.
- N. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 - 1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
 - 2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
 - a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
 - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
- O. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.
- P. Instrument Transformers:
 - 1. Comply with IEEE C57.13.
 - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
 - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
 - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.02 OVERCURRENT PROTECTIVE DEVICES

- A. Fusible Devices:
 - 1. Fusible Switches:
 - a. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
 - b. Fuse Clips: As required to accept indicated fuses.
 - c. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- B. Circuit Breakers:
 - 1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.

- b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
- c. Provide the following features and accessories where indicated or where required to complete installation:
 - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.03 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
 - 1. Dielectric tests.
 - 2. Mechanical operation tests.
 - 3. Grounding of instrument transformer cases test.
 - 4. Electrical operation and control wiring tests, including polarity and sequence tests.
 - 5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Install all field-installed devices, components, and accessories.
- J. Provide fuses complying with Section 262813 for fusible switches as indicated.
- K. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- L. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- M. Provide filler plates to cover unused spaces in switchboards.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

- C. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- D. Inspect and test in accordance with NETA ATS, except Section 4.
- E. Perform inspections and tests listed in NETA ATS, Section 7.1.
- F. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 225 amperes. Tests listed as optional are not required.
- H. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
 - 1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.
- I. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- J. Test shunt trips to verify proper operation.
- K. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

3.05 CLEANING

- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. See Section 017900 - Demonstration and Training, for additional requirements.

3.07 PROTECTION

- A. Protect installed switchboards from subsequent construction operations.

END OF SECTION 262413

SECTION 262416 PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 264300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e, with Amendment (2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- E. NEMA PB 1 - Panelboards 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- K. UL 67 - Panelboards Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- M. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- N. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
 1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 PRODUCTS

2.01 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the conditions at the installation location.
- C. Short Circuit Current Rating:
 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- G. Conductor Terminations: Suitable for use with the conductors to be installed.
- H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 2. Boxes: Galvanized steel unless otherwise indicated.
 - a. Provide wiring gutters sized to accommodate the conductors to be installed.
 - b. Provide removable end walls for NEMA Type 1 enclosures.
 3. Fronts:
 - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
 - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
 - J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.
 - K. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
 1. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
 - a. Use zero sequence ground fault detection method unless otherwise indicated.
 - b. Provide test panel and field-adjustable ground fault pick-up and delay settings.
 - L. Provide the following features and accessories where indicated or where required to complete installation:
 1. Feed-through lugs.
 2. Sub-feed lugs.

2.02 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 1. Phase and Neutral Bus Material: Aluminum.
 2. Ground Bus Material: Aluminum.
- D. Circuit Breakers:
 1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
- E. Enclosures:
 1. Provide surface-mounted enclosures unless otherwise indicated.
 2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.

2.03 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
 2. Phase and Neutral Bus Material: Aluminum.
 3. Ground Bus Material: Aluminum.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
 1. Provide surface-mounted or flush-mounted enclosures as indicated.
 2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
 3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 2. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 3. Conductor Terminations:
 - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
 6. Provide the following circuit breaker types where indicated:
 - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
 - b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
 7. Do not use handle ties in lieu of multi-pole circuit breakers.
 8. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
 9. Provide the following features and accessories where indicated or where required to complete installation:
 - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.05 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
- J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- K. Provide grounding and bonding in accordance with Section 260526.
 - 1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
- L. Install all field-installed branch devices, components, and accessories.
- M. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- N. Provide filler plates to cover unused spaces in panelboards.
- O. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
 - 1. Emergency and night lighting circuits.
 - 2. Fire detection and alarm circuits.
 - 3. Communications equipment circuits.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 250 amperes. Tests listed as optional are not required.
- D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- E. Test GFCI circuit breakers to verify proper operation.
- F. Test shunt trips to verify proper operation.
- G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262416

**SECTION 262726
WIRING DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Floor box service fittings.
- E. Poke-through assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 260533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification) 2014g, with Amendment (2017).
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2021.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.
- M. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
 - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
 - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
 - 5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
 - 6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

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

- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
 - 1. Wall Dimmers: Include derating information for ganged multiple devices.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for receptacles installed in dwelling units.
- E. Provide GFCI protection for receptacles installed within 6 feet of sinks.
- F. Provide GFCI protection for receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
- C. Wiring Devices Installed in Finished Spaces: White with white nylon wall plate.
- D. Wiring Devices Installed in Unfinished Spaces: White with white nylon wall plate.
- E. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.
- F. Flush Floor Box Service Fittings: White wiring devices with aluminum cover and ring/flange.
- G. Flush Poke-Through Service Fittings: White wiring devices with aluminum cover and aluminum flange.

2.03 WALL SWITCHES

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.
- B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

- A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

2.05 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- B. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - 2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
 - 3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
 - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 - 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
 - 4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
 - 5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.
- D. USB Charging Devices:
 - 1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
 - a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
 - b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
 - 2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

2.06 WALL PLATES

- A. Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Size: Standard.
 - 3. Screws: Metal with slotted heads finished to match wall plate finish.

- B. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- E. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- F. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.07 FLOOR BOX SERVICE FITTINGS

- A. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.
- B. Flush Floor Service Fittings:
 - 1. Single Service Flush Convenience Receptacles:
 - a. Cover: Rectangular.
 - b. Configuration: As shown on the drawings.
 - 2. Single Service Flush Communications Outlets:
 - a. Cover: Rectangular.
 - b. Configuration: As shown on the drawings.
 - 3. Single Service Flush Furniture Feed:
 - a. Cover: Rectangular.
 - b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
 - 4. Dual Service Flush Combination Outlets:
 - a. Cover: Rectangular.
 - b. Configuration:
 - 1) Power: As shown on the drawings.
 - 2) Communications: As shown on the drawings.
 - 5. Dual Service Flush Furniture Feed:
 - a. Cover: Rectangular.
 - b. Configuration:
 - 1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
 - 2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).
 - 6. Accessories:
 - a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
 - b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.08 POKE-THROUGH ASSEMBLIES

- A. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.
- B. Flush Floor Service Fittings:
 - 1. Single Service Flush Convenience Receptacles:
 - a. Configuration: As shown on the drawings.
 - 2. Single Service Flush Communications Outlets:
 - a. Configuration: As shown on the drawings.
 - 3. Dual Service Flush Combination Outlets:
 - a. Cover: Hinged door(s).
 - b. Configuration:
 - 1) Power: As shows on the drawings.

- 2) Communications: as shown on the drawings.
4. Accessories:
 - a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches above finished floor.
 - b. Wall Dimmers: 48 inches above finished floor.
 - c. Receptacles: 18 inches above finished floor or 6 inches above counter.
 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 3. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

- L. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- P. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 262726

**SECTION 262816.16
ENCLOSED SWITCHES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.
- D. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
 - 1. Altitude: Less than 6,600 feet.
 - 2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
 - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
 - 2. Minimum Ratings:
 - a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
 - 2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- M. Heavy Duty Switches:
 - 1. Comply with NEMA KS 1.
 - 2. Conductor Terminations:

- a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262816.16

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**SECTION 263213
ENGINE GENERATORS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Packaged engine generator system and associated components and accessories:
 - 1. Generator set enclosure.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 231123 - Facility Natural-Gas Piping.
- C. Section 235100 - Breechings, Chimneys, and Stacks: Engine exhaust piping.
- D. Section 260526 - Grounding and Bonding for Electrical Systems.
- E. Section 260529 - Hangers and Supports for Electrical Systems.
- F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 263600 - Transfer Switches.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA/EGSA 404 - Standard for Installing Generator Sets 2014.
- C. NEMA MG 1 - Motors and Generators 2021.
- D. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 99 - Health Care Facilities Code 2021, with Amendment.
- G. NFPA 110 - Standard for Emergency and Standby Power Systems 2022.
- H. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries Current Edition, Including All Revisions.
- I. UL 2200 - Stationary Engine Generator Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
 - a. Transfer Switches: See Section 263600.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.
 - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

1.05 SUBMITTALS

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

- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
- C. Manufacturer's factory emissions certification.
- D. Source quality control test reports.
- E. Manufacturer's detailed field testing procedures.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70 (National Electrical Code).
 - 2. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

- A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. System Description:
 - 1. Application: Emergency/standby.
 - 2. Configuration: Single packaged engine generator set operated independently (not in parallel).
- D. Packaged Engine Generator Set:
 - 1. Type: Gaseous (spark ignition).
 - 2. Power Rating: As indicated on drawings, standby.
 - 3. Voltage: As indicated on drawings.

4. Main Line Circuit Breaker:
 - a. Type: Thermal magnetic.
 - b. Trip Rating: Select according to generator set rating.
- E. Generator Set General Requirements:
 1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
 2. Factory-assembled, with components mounted on suitable base.
 3. List and label engine generator assembly as complying with UL 2200.
 4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
 5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
 6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.
- F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.
- G. Starting and Load Acceptance Requirements:
 1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
 2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
 3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
 4. Maximum Load Step: Supports 100 percent of rated load in one step.
- H. Exhaust Emissions Requirements:
 1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
 2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

- A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.
- B. Engine Fuel System - Gaseous (Spark Ignition):
 1. Fuel Source: Natural gas.
 2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
 3. Provide components/features indicated and as necessary for operation and/or required by applicable codes, including but not limited to:
 - a. Carburetor.
 - b. Gas pressure regulators.
 - c. Fuel shutoff control valves.
 - d. Low gas pressure switches.
- C. Engine Starting System:
 1. System Type: Electric, with DC solenoid-activated starting motor(s).
 2. Battery(s):
 - a. Battery Type: Lead-acid.

- b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
- c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
- 3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
- 4. Battery Charger:
 - a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
 - b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
 - c. Recognized as complying with UL 1236.
 - d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
 - e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
 - f. Provide alarm output contacts as necessary for alarm indications.
- 5. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.
- D. Engine Speed Control System (Governor):
 - 1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
 - 2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.
- E. Engine Lubrication System:
 - 1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
- F. Engine Cooling System:
 - 1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
 - 2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
 - 3. Coolant Heater: Provide thermostatically controlled coolant heater to improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.
- G. Engine Air Intake and Exhaust System:
 - 1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
 - 2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.

2.04 ALTERNATOR (GENERATOR)

- A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.
- B. Exciter:
 - 1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.

2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
 3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
- C. Temperature Rise: Comply with UL 2200.
- D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.
- E. Enclosure: NEMA MG 1, drip-proof.
- F. Total Harmonic Distortion: Not greater than five percent.

2.05 GENERATOR SET CONTROL SYSTEM

- A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.
- B. Control Panel:
1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
 2. Generator Set Control Functions:
 - a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
 - b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
 - c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
 - d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
 - e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
 - f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
 - g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
 3. Generator Set Status Indications:
 - a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
 - b. Current (Amps): For each phase.
 - c. Frequency (Hz).
 - d. Real power (W/kW).
 - e. Reactive power (VAR/kVAR).
 - f. Apparent power (VA/kVA).
 - g. Power factor.
 - h. Duty Level: Actual load as percentage of rated power.
 - i. Engine speed (RPM).
 - j. Battery voltage (Volts DC).
 - k. Engine oil pressure.
 - l. Engine coolant temperature.
 - m. Engine run time.
 - n. Generator powering load (position signal from transfer switch).
 4. Generator Set Protection and Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).

- 9) Generator control not in automatic mode (warning).
- 10) High battery voltage (warning).
- 11) Low cranking voltage (warning).
- 12) Low battery voltage (warning).
- 13) Battery charger failure (warning).
- b. In addition to NFPA 110 requirements, provide the following protections/indications:
 - 1) High AC voltage (shutdown).
 - 2) Low AC voltage (shutdown).
 - 3) High frequency (shutdown).
 - 4) Low frequency (shutdown).
 - 5) Overcurrent (shutdown).
- c. Provide contacts for local and remote common alarm.
- d. Provide lamp test function that illuminates all indicator lamps.
5. Other Control Panel Features:
 - a. Event log.
- C. Remote Annunciator:
 1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
 2. Generator Set Status Indications:
 - a. Generator powering load (via position signal from transfer switch).
 - b. Communication functional.
 3. Generator Set Warning/Shutdown Indications:
 - a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:
 - 1) Overcrank (shutdown).
 - 2) Low coolant temperature (warning).
 - 3) High coolant temperature (warning).
 - 4) High coolant temperature (shutdown).
 - 5) Low oil pressure (shutdown).
 - 6) Overspeed (shutdown).
 - 7) Low fuel level (warning).
 - 8) Low coolant level (warning/shutdown).
 - 9) Generator control not in automatic mode (warning).
 - 10) High battery voltage (warning).
 - 11) Low cranking voltage (warning).
 - 12) Low battery voltage (warning).
 - 13) Battery charger failure (warning).
 - b. Provide audible alarm with silence function.
 - c. Provide lamp test function that illuminates all indicator lamps.

2.06 GENERATOR SET ENCLOSURE

- A. Enclosure Type: Sound attenuating, weather protective.
- B. Enclosure Material: Steel or aluminum.
- C. Hardware Material: Stainless steel.
- D. Color: Manufacturer's standard.
- E. Access Doors: Lockable, with all locks keyed alike.
- F. Openings: Designed to prevent bird/rodent entry.
- G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.

- H. Sound Attenuating Enclosures: Line enclosure with non-hydrscopic, self-extinguishing sound-attenuating material.

2.07 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive equipment.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.
- D. Arrange equipment to provide minimum clearances and required maintenance access.
- E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch high concrete pad constructed in accordance with Section 033000.
- F. Provide required support and attachment in accordance with Section 260529.
- G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.
- H. Provide natural gas piping in accordance with Section 231123.
- I. Provide engine exhaust piping in accordance with Section 235100, where not factory installed.
 - 1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
 - 2. Do not exceed manufacturer's maximum back pressure requirements.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Identify system wiring and components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.
- D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.
- F. Preliminary inspection and testing to include, at a minimum:
 - 1. Inspect each system component for damage and defects.

2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
 3. Check for proper oil and coolant levels.
- G. Prepare and start system in accordance with manufacturer's instructions.
 - H. Perform acceptance test in accordance with NFPA 110.
 - I. Provide field emissions testing where necessary for certification.
 - J. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. See Section 017900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.06 PROTECTION

- A. Protect installed engine generator system from subsequent construction operations.

END OF SECTION 263213

SECTION 263600 TRANSFER SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
 - 1. Automatic transfer switches.
 - 2. Remote annunciators.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment 2020.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 1008 - Transfer Switch Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
 - 2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
 - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
- C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- E. Source quality control test reports.

- F. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70 (National Electrical Code).
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Transfer Switches:
 - 1. ABB/GE: www.electrification.us.abb.com/#sle.
 - 2. ASCO Power Technologies: www.ascopower.com/#sle.
 - 3. Eaton Corporation: www.eaton.com/#sle.
 - 4. Same as manufacturer of engine generator(s) used for this project.
- B. Source Limitations: Furnish transfer switches and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 TRANSFER SWITCHES

- A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Applications:
- D. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.
- E. Automatic Transfer Switch:
 - 1. Transfer Switch Type: As indicated on the drawings.
 - 2. Voltage: As indicated on the drawings.
 - 3. Ampere Rating: As indicated on the drawings.
 - 4. Neutral Configuration: Solid neutral (unswitched), except as indicated.
 - 5. Load Served: As indicated on the drawings.
 - 6. Primary Source: As indicated on the drawings.
 - 7. Alternate Source: As indicated on the drawings.

- F. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).
- G. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.
- H. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.
- I. Switching Methods:
 - 1. Obtain control power for transfer operation from line side of source to which the load is to be transferred.
- J. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.
- K. Enclosures:
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 2. Finish: Manufacturer's standard unless otherwise indicated.
- L. Short Circuit Current Rating:
- M. Automatic Transfer Switches:
 - 1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.
 - 2. Control Functions:
 - a. Automatic mode.
 - b. Test Mode: Simulates failure of primary/normal source.
 - c. Voltage and Frequency Sensing:
 - 1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
 - 2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
 - 3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.
 - d. Outputs:
 - 1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
 - 2) Auxiliary contacts; one set(s) for each switch position.
 - e. Adjustable Time Delays:
 - 1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
 - 2) Transfer to alternate/emergency source time delay.
 - 3) Retransfer to primary/normal source time delay.
 - 4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.
 - f. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.
 - 3. Status Indications:
 - a. Connected to alternate/emergency source.
 - b. Connected to primary/normal source.
 - c. Alternate/emergency source available.
 - 4. Automatic Sequence of Operations:

- a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.
 - b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.
 - c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.
 - d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.
- N. Remote Annunciators:
1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
 2. Transfer Switch Status Indications:
 - a. Connected to alternate/emergency source.
 - b. Connected to primary/normal source.
 - c. Alternate/emergency source available.

2.03 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.
- C. Verify that rough-ins for field connections are in the proper locations.
- D. Verify that mounting surfaces are ready to receive transfer switches.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install transfer switches plumb and level.
- F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.
- G. Provide grounding and bonding in accordance with Section 260526.
- H. Identify transfer switches and associated system wiring in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Prepare and start system in accordance with manufacturer's instructions.
- C. Automatic Transfer Switches:
 1. Inspect and test in accordance with NETA ATS, except Section 4.
 2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.

- D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.06 PROTECTION

- A. Protect installed transfer switches from subsequent construction operations.

END OF SECTION 263600

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**SECTION 264300
SURGE PROTECTIVE DEVICES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surge protective devices for service entrance locations.
- B. Surge protective devices for distribution locations.
- C. Surge protective devices for branch panelboard locations.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 262413 - Switchboards.
- C. Section 262416 - Panelboards.

1.03 ABBREVIATIONS AND ACRONYMS

- A. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
- C. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- D. Project Record Documents: Record actual connections and locations of surge protective devices.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- B. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
- B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. Protected Modes:
 - 1. Wye Systems: L-N, L-G, N-G, L-L.
 - 2. Delta Systems: L-G, L-L.
- E. UL 1449 Voltage Protection Ratings (VPRs):
 - 1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
 - 2. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.
- F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 1. Indoor clean, dry locations: Type 1.
 - 2. Outdoor locations: Type 3R.
- H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
- I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
 - 1. Switchboards: See Section 262413.
 - 2. Panelboards: See Section 262416.

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

- A. Surge Protective Device:
 - 1. Protection Circuits: Field-replaceable modular or non-modular.
 - 2. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.
 - 3. UL 1449 Nominal Discharge Current (I-n): 20 kA.

4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
5. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
 - c. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

2.04 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

- A. Distribution locations include SPDs connected to distribution panelboards, motor control centers, and busway.
- B. Surge Protective Device:
 1. Protection Circuits: Field-replaceable modular or non-modular.
 2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
 3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
 4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
 5. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

2.05 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

- A. Surge Protective Device:
 1. Protection Circuits: Field-replaceable modular or non-modular.
 2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
 3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
 4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
 5. Diagnostics:
 - a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
 - b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
- B. Products - Field-installed, Externally Mounted Surge Protective Devices:

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.

- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.
- E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
- F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.04 CLEANING

- A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 264300

**SECTION 265100
INTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Lamps.
- F. Luminaire accessories.

1.02 RELATED REQUIREMENTS

- A. Section 260533.16 - Boxes for Electrical Systems.
- B. Section 262726 - Wiring Devices: Manual wall switches and wall dimmers.

1.03 REFERENCE STANDARDS

- A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts 2017.
- B. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information 2002 (Reaffirmed 2008).
- D. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.
- E. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- F. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- G. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems 2006.
- H. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 2006.
- I. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2020.
- J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012 (Reaffirmed 2018).
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
- N. UL 1598 - Luminaires Current Edition, Including All Revisions.
- O. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
 2. Provide photometric calculations where luminaires are proposed for substitution upon request.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
 1. LED Luminaires:
 - a. Include estimated useful life, calculated based on IES LM-80 test data.
 - b. Include IES LM-79 test report upon request.
 2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
 3. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
 4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
- D. Certificates for Dimming Ballasts: Manufacturer's documentation of compatibility with dimming controls to be installed.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.
- C. Cover installed fixtures to protect from construction dust/debris until after final cleaning of areas is completed.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

- B. Provide three year manufacturer warranty for all LED luminaires, including drivers.
- C. Provide two year manufacturer warranty for all linear fluorescent ballasts.
- D. Provide five year pro-rata warranty for batteries for emergency lighting units.

PART 2 PRODUCTS

2.01 MANUFACTURERS - LUMINAIRES

- A. Acuity Brands, Inc: www.acuitybrands.com.
- B. Cooper Lighting, a division of Cooper Industries: www.cooperindustries.com.
- C. Hubbell Lighting, Inc: www.hubbellighting.com.
- D. See lighting fixture schedule for owner provided fixtures and/or fixtures not eligible for substitution.
- E. Substitutions: See Section 016000 - Product Requirements except where individual luminaire types are designated with substitutions not permitted.

2.02 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 016000 - Product Requirements except where individual luminaire types are designated with substitutions not permitted.

2.03 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
 - 1. Ceiling Compatibility: Comply with NEMA LE 4.
 - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
 - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- H. Fluorescent Luminaires:
 - 1. Provide ballast disconnecting means complying with NFPA 70 where required.
 - 2. Fluorescent Luminaires Controlled by Occupancy Sensors: Provide programmed start ballasts.
 - 3. Fluorescent Luminaires Controlled by Dual-Level Switching: Provide with two ballasts.
 - a. Luminaires with Two Lamps: Each ballast controls one lamp.
 - b. Luminaires with Three Lamps: One ballast controls two outer lamps and one ballast controls inner lamp.
- I. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.04 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
 - 1. Sealed maintenance-free lead calcium unless otherwise indicated.
 - 2. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.
- F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

2.05 EXIT SIGNS

- A. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
 - 1. Number of Faces: Single or double as indicated or as required for the installed location.
 - 2. Directional Arrows: As indicated or as required for the installed location.

2.06 BALLASTS AND DRIVERS

- A. All Ballasts:
 - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
 - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- B. Fluorescent Ballasts:
 - 1. All Fluorescent Ballasts: Unless otherwise indicated, provide high frequency electronic ballasts complying with ANSI C82.11 and listed and labeled as complying with UL 935.
 - a. Inrush Current: Not exceeding peak currents specified in {rs#1}.
 - b. Input Voltage: Suitable for operation at voltage of connected source, with variation tolerance of plus or minus 10 percent.
 - c. Total Harmonic Distortion: Not greater than 10 percent.
 - d. Power Factor: Not less than 0.95.
 - e. Ballast Factor: Normal ballast factor between 0.85 and 1.15, unless otherwise indicated.
 - f. Thermal Protection: Listed and labeled as UL Class P, with automatic reset for integral thermal protectors.
 - g. Sound Rating: Class A, suitable for average ambient noise level of 20 to 24 decibels.
 - h. Lamp Compatibility: Specifically designed for use with the specified lamp, with no visible flicker.
 - i. Lamp Operating Frequency: Greater than 20 kHz, except as specified below.
 - j. Lamp Current Crest Factor: Not greater than 1.7.
 - k. Provide automatic restart capability to restart replaced lamp(s) without requiring resetting of power.
 - l. Provide end of lamp life automatic shut down circuitry for T5 and smaller diameter lamp ballasts.

- m. Surge Tolerance: Capable of withstanding characteristic surges according to IEEE C62.41.2, location category A.
 - n. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of CFR, Title 47, Part 18, for Class A, non-consumer application.
 - o. Ballast Marking: Include wiring diagrams with lamp connections.
- C. Dimmable LED Drivers:
- 1. Dimming Range: Continuous dimming from 100 percent to one percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.
 - a. Wall Dimmers: See Section 262726.
 - 3. Product(s):
 - a. Lutron Hi-Lume A-Series: Forward phase (neutral wire required), 3-wire, and digital control; one percent dimming.

2.07 LAMPS

- A. Manufacturers:
- 1. General Electric Company/GE Lighting; _____: www.gelighting.com/#sle.
 - 2. Osram Sylvania; _____: www.sylvania.com/#sle.
 - 3. Philips Lighting Company; _____: www.lighting.philips.com.
 - 4. Substitutions: See Section 016000 - Product Requirements.
 - 5. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
- B. Lamps - General Requirements:
- 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
 - 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
 - 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
 - 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

2.08 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
- D. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as shown on the drawings.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Install products according to manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 1 (general workmanship) and NECA 1 (general workmanship).
- D. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- E. Suspended Ceiling Mounted Luminaires:
 - 1. Do not use ceiling tiles to bear weight of luminaires.
 - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
 - 3. Secure surface-mounted and recessed luminaires to building structure.
 - 4. Secure pendant-mounted luminaires to building structure.
 - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
 - 6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
 - 7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- F. Recessed Luminaires:
 - 1. Install trims tight to mounting surface with no visible light leakage.
- G. Suspended Luminaires:
 - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
 - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
 - 3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.
 - 4. Install canopies tight to mounting surface.
 - 5. Unless otherwise indicated, support pendants from swivel hangers.
- H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- I. Install accessories furnished with each luminaire.
- J. Bond products and metal accessories to branch circuit equipment grounding conductor.
- K. Fluorescent Luminaires Controlled by Dual-Level Switching: Connect such that each switch controls the same corresponding lamps in each luminaire.
- L. Emergency Lighting Units:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
 - 2. Install lock-on device on branch circuit breaker serving units.
- M. Exit Signs:
 - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

- N. Install lamps in each luminaire.
- O. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Test emergency lighting units to verify proper operation upon loss of normal power supply.
- E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265100

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**SECTION 265600
EXTERIOR LIGHTING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Exterior luminaires.
- B. Drivers.

1.02 RELATED REQUIREMENTS

- A. Section 260529 - Hangers and Supports for Electrical Systems.
- B. Section 260533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

- A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products 2019.
- B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources 2021.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems 2000 (Reaffirmed 2006).
- E. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts 2020.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 1598 - Luminaires Current Edition, Including All Revisions.
- H. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
 - 2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
 - 1. LED Luminaires:

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 016000 - Product Requirements.

2.02 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- H. LED Luminaires:
 - 1. Components: UL 8750 recognized or listed as applicable.
 - 2. Tested in accordance with IES LM-79 and IES LM-80.
 - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 DRIVERS

- A. Drivers - General Requirements:
 - 1. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.
- B. Dimmable LED Drivers:
 - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
 - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- C. Verify that suitable support frames are installed where required.

- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires in accordance with NECA/IESNA 501.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Install accessories furnished with each luminaire.
- G. Bond products and metal accessories to branch circuit equipment grounding conductor.
- H. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each product for damage and defects.
- C. Operate each luminaire after installation and connection to verify proper operation.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.06 CLEANING

- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

- A. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265600

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SECTION 271000 COMMUNICATIONS

PART 1 – GENERAL

1.1 SUMMARY

- A. Section includes products and execution requirements pertaining to Division 27 systems. Copper and fiber backbone and horizontal cabling along with support systems are covered under this document.
- B. Product specifications, general design considerations, and installation guidelines are provided in this document. Quantities for all structured cabling products shall be provided as required to complete the horizontal cabling for all workstations as shown on floor plans.
- C. The same manufacturer's product shall be utilized throughout the entire project for all copper and fiber optic structured cabling.
- D. Specification is based on a nCompass cabling system comprised of Legrand and Superior Essex products.
- E. For approved equal see 1.3 for substitution request requirements. No substituted products shall be installed except with written approval by Owner.

1.2 TELECOMMUNICATIONS SYSTEM WORK

- A. General:
 - 1. Furnish all labor, materials, tools, equipment and services for the installation in accordance with general provisions of specifications and the Contract Drawings.
 - 2. Report percentage of work completed on a monthly basis.
 - 3. Completely coordinate with work of all other trades.
 - 4. Provide and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation, whether or not specifically indicated in the Contract Documents.
 - 5. Provide and install all floor penetrations, floor sleeves, conduit raceways, wall penetrations, etc. not shown on the electrical plans but needed for the routing of cabling provided herein.
 - 6. Provide and install all cords in the work area, telecommunication rooms and equipment room.
 - 7. Provide labor for testing horizontal and backbone cabling.
 - 8. Provide and install fire stopping.
 - 9. Provide and install telecommunications bonding and grounding system.
- B. Provide and install complete installation for Structured Telecommunications Cabling and Physical Support System including but not limited to
 - 1. Category 6 UTP horizontal cables.
 - 2. Category 6 modules and patch panels.
 - 3. Category 6 cords
 - 4. Category 6a UTP horizontal cables.
 - 5. Category 6a modules and patch panels.
 - 6. Category 6a cords
 - 7. Work area telecommunication outlets of equal performance to the horizontal cable.
 - 8. Wall mounted outlets of equal performance to the horizontal cable

9. Multimode optical fiber premise backbone cables.
10. Singlemode
11. Optical fiber enclosures.
12. Optical fiber connectors.
13. Optical fiber patch cords.
14. Equipment mounting racks and rack enclosures.
15. Wire management
16. Field testing.
17. Conduit floor sleeves, conduit and supports required for installation of all cabling.
18. Grounding and bonding system

19. Fire stopping.

C. Purchasing

1. Purchase all materials from an authorized Distributor
2. Provide complete price breakdown of material and handling fees.

3. All material required for completion shall be new for project

1.3 SUBSTITUTIONS

A. Prior to bid

1. Any structured cabling product substitutions, from another manufacturer, shall not qualify for nCompass Limited Lifetime Premium Warranty.
2. All substitution requests shall be submitted to Engineer 10 business day prior to bid date for Owner approval.
3. All specified part numbers shall be individually address and part numbers being requested as "equal" shall be stated.
4. All part numbers being requested as "equal" shall meet all "shall" stated requirements for that product.
5. Provide supporting "equal" documentation for each individual part number. The following shall be included but not limited too.
 - a. Data sheets of each part number
 - b. 3rd party test results with performance guarantees highlighted

 - c. Sample of each part number being requested as "equal"

1.4 SUBMITTALS

A. With Bid

1. Contractor shall submit Legrand Data Infrastructure (DAT) company certificate.
2. Training certificate of telecommunications contractor doing the work shall be submitted with bid.

3. Certificate and letter shall state that contractor is a CIP-Elite (formerly CIP-ESP) or CIP within the DAT contractor certification program.

B. Prior to Start of Work

1. Submittals shall be submitted in one single package. Partial submittals will not be considered.
2. Material lists, schedule of values, lists of subcontractors, and proof of Contractor qualifications shall be provided to Owner/ Engineer
3. Performance bonds, payment bonds, and insurance certifications shall be submitted by the Contractor prior to execution of the contract.
4. Shop drawings shall be submitted to Owner/ Engineer. All communication system shop drawings shall include:
 - a. Manufacturer's data (specifications, "cut sheets").
 - b. Wiring diagrams for all installed cabling.
 - c. Equipment rack/cabinet layouts.
 - d. Proposed labeling schemes and labeling method.
 - e. List of cabling distances (typical and maximum) for all structured cabling
 - f. Copies of training certificates for all technicians and the project manager who will support this project.
 - 1) A list of managers and technicians certified
 - 2) Approved manufacturer classes satisfactorily completed.
 - g. Contractor shall submit a test plan with the submittal package that defines the tests required to ensure that the system meets technical, operational, and performance specifications. The test plan must also meet manufacturer's certification requirements.
 - h. Work shall not proceed without the Owner/ Engineer approval of the submitted items.
5. Drawings & Inspection of Site:
 - a. Communications floor plan drawings are to scale and typically are not dimensioned. The Contractor shall not scale drawings for equipment placement and clearances. Dimensions given on drawings shall always take precedence over scaled drawings.
 - b. Any existing wires, utilities, or equipment shown on the drawings are shown for general information and to the best knowledge of the Owner/ Engineer. The Contractor shall field verify all existing wires, utilities, or equipment.
 - c. The Contractor shall field verify distances and equipment placements coordinating locations with other trades, construction managers, and General Contractor prior to installation.
 - d. If possible, the Contractor shall review all site conditions prior to submitting a bid on this project. Any obvious discrepancies between the site conditions and bidding documents shall be brought to the attention of the Owner/ Engineer at the time of bidding so clarification can be made by addendum.
 - e. Change order requests for additional costs related to the contractors misunderstanding related to the amount of work involved and lack of knowledge related to the site conditions will not be allowed.
 - f. Convene pre-installation meeting 2 weeks prior to start of installation of horizontal communications cabling. This meeting will review installation timeline and allow for coordination with additional contractors on site.
6. Test Reports: Submit copies of complete reports of all testing performed to the General Contractor, with copies to the Owner/ Engineer prior to job completion.

- C. After project completion
 - 1. Contractor must register project for the nCompass premium warranty within 30 days of project completion using the Legrand DAT online system.
 - 2. A copy of the warranty certificate shall be submitted to the Owner/Engineer.

1.5 QUALITY ASSURANCE

- A. Installation Reference Standards (all codes and standards compliance will be to the most current revision available), including applicable addendums. Cable installation shall comply with the following:
 - 1. NEC® 2020: National Electric Code®, 2020. Use the most current revision required by location.
 - 2. ANSI/TIA-568.0: Generic Communications Cabling for Customer Premises.
 - 3. ANSI/TIA -568.1: Commercial Building Telecommunications Infrastructure Standard.
 - 4. ANSI/TIA-568.2: Balanced Twisted Pair Telecommunications Cabling and Components Standard.
 - 5. ANSI/TIA-568.3: Optical Fiber Cabling Standard.
 - 6. ANSI/TIA-569: Telecommunications Pathways and Spaces
 - 7. ANSI/TIA-606: Administration Standard for Telecommunications infrastructure.
 - 8. ANSI/TIA-607: Generic Telecommunications Bonding and Grounding (Earthing) for customer premises.
 - 9. ANSI/TIA-758: Customer Owned Outside Plant Telecommunications Infrastructure Standard
 - 10. ANSI/TIA-526-7: Optical Power Measurements of Installed Single Mode Fiber Cable
 - 11. TIA-526-14: Optical Power Loss Measurements of Installed Multimode Fiber Cable
 - 12. TIA-598: Optical Fiber Cable Color Coding.
 - 13. BICSI-TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual
 - 14. ISO/IEC 11801-1 Part 1: General Requirements.
 - 15. ISO/IEC 11801-2, Part 2: Office Premises.
- B. Horizontal Cabling System Performance
 - 1. Shall be (per drawings) a Cat 6 or Cat 6a nCompass copper cabling system as defined on the applicable nCompass data sheet.
 - a. Shall be backed by a Limited Lifetime Warranty guaranteeing ANSI/TIA 568 compliance
- C. Materials:
 - 1. All materials shall be UL or ETL listed and verified and shall be marked as such.
 - 2. Products shall be regularly catalogued items of the manufacturer and shall be supplied as a complete unit in accordance with the manufacturer's standard specifications with any optional items required for proper installation unless otherwise noted.
 - 3. Material shall be delivered to the site in the original packing.
 - 4. Approved Products
 - a. 4-pair TP Horizontal Cable: Superior Essex
 - b. Optical Fiber Cable: Superior Essex

c. RJ45 Outlets:	Legrand (Ortronics)
d. Copper Patch Cords:	Legrand (Ortronics)
e. Fiber Optic Cabinets:	Legrand (Ortronics)
f. Fiber Optic connectors/splices/couplers:	Legrand (Ortronics)
g. Rack and Cabinet:	Legrand (Ortronics)
h. Patch Panel:	Legrand (Ortronics)
i. Fiber Optic Patch Cords:	Legrand (Ortronics)
j. Ladder Rack	Legrand (Ortronics)
k. Cable Tray & J-Hooks	Legrand (Cablofil)
l. Poke-Thru Devices	Legrand (Wiremold)

D. Contractor Qualifications:

1. The Contractor shall have experience in the installation and testing of similar systems as specified herein and shall have completed at least two projects of similar size and scope within the last 24 months. The Contractor shall provide references upon request (including the project name, address, date of implementation, client name, title, telephone number, and project description.)
2. The Contractor bidding on communication systems specified herein shall be certified by Data Infrastructure (part of the Data, Power & Control Division of Legrand) at a CIP-Elite (formerly CIP-ESP) or CIP level. The awarded contractor must be able to install, service, and warranty the specified product prior to the time of bid and throughout the duration of the installation; or, the bidding Contractor shall utilize a sub-Contractor(s) certified by Ortronics (d.b.a. Data Infrastructure) to install, service, and warranty the specified product. The awarded contractor must be eligible to support the nCompass™ Limited Lifetime Warranty. Manufacturer certifications shall not be project specific and should be valid for any and all projects completed by Contractor.
3. The Contractor must meet all training requirements from Ortronics as a CIP-Elite (formerly CIP-ESP) or CIP contractor. The contractor must be in good standing with minimum 30% of the technicians on site and at least one manager current with the required training.
4. The contractor is responsible for workmanship and installation practices in accordance with Ortronics Certified Contractor Program for structured cabling installation.
5. The Contractor must maintain a state Contractor's license as required by the state.
6. The Contractor installing the structured cabling shall have a BICSI Installer 2 (minimum) certification on site as project foreman.
7. The Contractor installing the structured cabling shall have a RCDD functioning as project supervisor. The Contractor's RCDD/project supervisor shall complete at a minimum the following tasks.
 - a. Review and submit Contractor's shop drawings.
 - b. Conduct weekly site visits to review the installation and progress of the structured cabling during the communications installation phase of the project.
 - c. Review and sign completed punch list items.
 - d. Review and submit Contractor's as-built documentation.
8. The Contractor shall provide copies of certificates for proof of manufacturer's training, manufacturer's certified contractor company certification and name of authorized

distributor in the shop drawing submittal and at the request of the Owner/ Engineer to verify compliance with specification prior to recommendations for awarding bid.

1.6 MAINTENANCE

- A. All materials used on this project shall be new. Used and refurbished equipment is not permitted. Provide equipment to site in original packaging whenever practical.
- B. The contractor is responsible for scheduling all deliveries and providing proper receipt, handling, and storage of all materials. Protect all equipment from physical damages (dents, scratches, dust, water, paint, chemicals, and temperature extremes) and vandalism, or theft. The Contractor shall replace any damaged or stolen equipment. The Contractor is responsible for all equipment until final project acceptance by Owner.

1.7 WARRANTY

- A. nCompass Premium Limited Lifetime warranty will be required as described below for the following systems or system components.
 - 1. nCompass Category 6 CMP/CMR Copper and Fiber Cabling, Fiber and Copper Connectivity Hardware, and Patch Cables shall be covered by a, nCompass Limited Lifetime warranty labor, and application assurance warranty. The application assurance portion shall provide coverage for the cabling system to support the applications that are designed for the specifications outlined in TIA/EIA 568. These applications include, but are not limited to 10BASE-T, 100BASE-T, 1000BASE-T, and 155 Mb/s ATM.
 - 2. nCompass Category 6a CMP/CMR Copper and Fiber Cabling, Fiber and Copper Connectivity Hardware, and Patch Cables shall be covered by a, nCompass Limited Lifetime warranty labor, and application assurance warranty. The application assurance portion shall provide coverage for the cabling system to support the applications that are designed for the specifications outlined in TIA/EIA 568. These applications include, but are not limited to 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-T and 155 Mb/s ATM.
- B. Telecommunication Contractor must submit the following to Legrand
 - 1. Warranty Application properly completed online using the DAT contractor dashboard.
 - 2. Test results submitted only in the field tester's native, electronic format for both the copper and fiber optic systems. The test results must be submitted in original native tester format. (Note: Hard copies, WORD document formats, EXCEL spreadsheet formats and PDFs will not be accepted.)
 - 3. All tests must result in a PASS. Pass* (marginal pass) and Fail are not acceptable test results
 - 4. Each permanent link or channel in the network must be field tested in accordance with the TIA-568 industry standard AND nCompass testing requirements in force at the time of purchase (nCompass testing requirements take precedence over TIA when differences exist). The installed permanent links and channels must have passed all applicable TIA and nCompass performance requirements.
 - 5. Minimum testing for copper systems includes Wire Map, Length, Attenuation, Near End Crosstalk, Far End Crosstalk, Return Loss, PS NEXT, ELFEXT, and PS ELFEXT.
 - a. Field terminated plugs shall be tested in a permanent link configuration with the appropriate test equipment for field terminated plugs.

6. Minimum testing for Fiber Optic links includes horizontal and backbone, Bi-Directional Dual Wavelength, Insertion Loss and Length.
- C. Once the submitted materials are reviewed, the Telecommunications Contractor will be notified in writing of acceptance or rejection. If the project is accepted, the contractor will receive a copy of the signed warranty certificate for the Owner. If rejected, contractor must fix identified issues and resubmit using DAT contractor dashboard.
- D. Telecommunication Contractor shall forward the signed warranty certificate to the Owner.

PART 2 – PRODUCTS

2.1 OPEN CABLE TRAY, LADDER RACK AND SUPPORT SYSTEM

- A. Cable Tray System
 1. Cable tray shall consist of continuous, rigid, welded steel wire mesh cable management system with continuous Safe-T-Edge T welded top side to protect cable insulation.
 2. Cable tray composition Carbon Steel wire, ASTM A 510, Grade 1008.
 3. Approved manufacture: Cablofil
- B. J Hooks
 1. Provide and install J Hooks to support cables where cable tray is not installed.
 2. J Hooks installed shall have a 65 lbs. static load capacity.
 3. J Hooks shall have rounded edge and provide proper bend radius support of copper and fiber cables.
 4. J-Hooks shall have a metal cable retainer.
 5. Provide necessary attachments brackets to install J Hooks. i.e. flanges, purlin, rod/wire, angle or straight as needed.
 6. Finish: Pre-Galvanized
 7. Approved manufacture: Cablofil
 - a. CJ12H(3/4")
 - b. CJ21H (1-5/16")
 - c. CJ32H (2")
 - d. CJ64H(4")
- C. Universal Style Tubular Runway (9-inch spacing)
 1. Provide and install cable runway as per drawings for Telecommunications Rooms, either 12" or 18" as specified
 2. Runway shall be black
 3. Approved manufacture and part numbers: Legrand
 - a. URT10-12B (12 in. wide)
 - b. URT10-18B (18 in. wide)
- D. Telco Style Tubular Runway (9-inch spacing)
 1. Provide and install cable runway as per drawings for Telecommunications Rooms, either 12" or 18" wide as specified
 2. Runway shall be black

3. Approved manufacture and part numbers: Legrand
 - a. TRT10-12B (12 in. wide)
 - b. TRT10-18B (18 in. wide)
- E. Runway (universal or telco): Straight and Corner Clamps
 1. Provide and install clamps as needed.
 2. Color: Black
 3. Approved manufacture and part numbers: Legrand
 - a. P820127H (straight clamp)
 - b. P820147H (corner clamp)
- F. Runway (universal or telco): Wall Angle Assembly (when securing to wall)
 1. Provide and install wall angle assemblies as needed to secure tubular runway to wall.
 2. Install 12" or 18" wall angle assemblies as needed.
 3. Color: Black
 4. Manufacturer & Part Number: Legrand
 - a. P128240HB
 - b. P128440HB
- G. Shelf Brackets for Heavy Duty Runway Support
 1. Shelf brackets attach to the wall and extend out to 24" for heavy duty runway support.
 2. Provide and install 12" or 18" brackets as needed.
 3. Color: Black
 4. Manufacturer & Part Number: Legrand
 - c. P139340HB
 - d. P139540HB
- H. Rack to Runway Junction Plate for 2-post Racks
 1. Provide and install rack to runway bracket on all racks installed to secure runway to standard 2-post racks.
 2. Color: Black
 3. Approved manufacture and part numbers: Legrand
 - a. JP0606B
 - b. JP0612B
 - c. JP1218B
 - d. JP1824B
- I. Adjustable Runway Kit for 4-post Racks
 1. Adjustable Runway Kit shall include two top angle brackets and two side brackets for parallel or perpendicular mounting
 2. Brackets shall create a strong bond between the rack and the runway for solid overhead cable support
 3. Adjustable Runway Kit shall be RoHS compliant
 4. Adjustable Runway Kit shall be Buy American Act Compliant

5. Color: Black
6. Provide and install adjustable runway kit on all racks installed to secure runway to standard 4-post racks.
7. Approved manufacture and part numbers: Legrand
 - a. MM20C***

JT Transition Pans

1. Provide and install transition pans when cable leaves runway and into rack.
2. Color: Black
3. Approved manufacture and part numbers: Legrand
 - a. TRP11-CM (for 12 in. runway)
 - b. TRP17-CM (for 18 in. runway)

K. Protective Rubber End Caps

1. Use protective end caps to conceal sharp runway edges.
2. Color: Black
3. Approved manufacture and part numbers: Legrand
 - a. 2-E1-25C-A

L.E nd Closing kit

1. Used to close off section of runway.
2. Color: Black
3. Approved manufacture and part numbers: Legrand
 - a. RECBK-12B (for 12 in. runway)
 - b. RECBK-18B (for 18 in. runway)

2.2 LOCAL AREA NETWORK CABLE

- A. If a given application requires product(s) outside of this section of the specification to be employed, the premium warranty will apply as long as the chosen product(s) is(are) listed on the nCompass Premium Cabling System data sheet.
- B. Category 6 Horizontal Cable
 1. Cable shall be 100 Ohm, 23 AWG, 4 pair solid copper.
 2. Cable shall be tested to 550 MHz by the manufacturer with guaranteed performance to 250 MHz.
 3. Cable shall have footage and unique alpha numeric CableID printed on the jacket every 2 feet.
 4. Cable shall have ColorTip circuit identification making individual pairs easily identifiable by color.
 5. Cable shall be UL listed CMP or CMR as required by installation location.

6. Approved manufacture and part numbers: Superior Essex Datagain Series CAT6+
 - a. Plenum Rated 66-240-xB (x=jacket color)
 - b. Riser Rated 66-240-xA (x=jacket color)
- C. Category 6a Horizontal Cable
1. Cable shall be 100 Ohm, 23 AWG, 4 pair solid copper.
 2. Unshielded cable design shall be of a non-continuous metallic foil
 3. Cable shall be tested to 650 MHz by the manufacturer with guaranteed electrical performance out to 500MHz
 4. Cable shall have footage and unique alpha numeric CableID printed on the jacket every 2 feet.
 5. Cable shall have ColorTip circuit identification making individual pairs easily identifiable by color.
 6. Cable shall be UL listed CMP or CMR as required by installation location.
 7. Approved manufacture and part numbers: Superior Essex 10Gain XP+ CAT 6A
 - a. Plenum Rated 6B-272-xB (x=color)
 - b. Riser Rated 6B-272-xA (x=color)
- D. Single-mode Optical Fiber Cable
1. UL listed OFNP or OFNR as required by installation location
 2. Cable shall be reinforced with Aramid yarn and contain no metallic elements.
 3. Optical fiber cable shall have an attenuation value not to exceed 0.70 dB per kilometer at 1310 nm and 1550 nm.
 4. Single-mode optical fiber cable shall have a yellow jacket
 5. Approved manufacture and part numbers: Superior Essex TeraFlex® G.657.A1 Single Mode
 - a. 44012K101 (OS2 Plenum Rated, 12 strand)
 - b. 43012K101 (OS2 Riser Rated, 12 strand)

2.3 Copper Termination Hardware

- A. If a given application requires product(s) outside of this section of the specification to be employed, the premium warranty will apply as long as the chosen product(s) is(are) listed on the nCompass Premium Cabling System data sheet.
- B. Category 6 Module
 1. Module performance rating shall be clearly marked on the front of the module
 2. Provide and install 8 position – 8 conductor non-keyed Outlets per drawing
 3. Module shall support both T568B & T568A wiring configurations
 4. Same module shall be used in faceplate and patch panel
 5. Module's circuit traces shall be rated to 1.5 Amps current carrying capacity
 6. Module's contacts shall have 50 micro inches of gold plating
 7. Module's contacts shall be designed to minimize spark gap erosion
 8. Module shall be rear loading
 9. Module must mount to the device using a locking latch for quick reliable mounting and easy, toolless removal while supporting a minimum 50lbs of force retention

10. Module must support a minimum of 35lbs of force retention to the cable at the point of termination.
11. Module shall use lacing cap/crimp termination method
12. Module shall allow color coding via icon designation for each port
13. Module shall work with faceplates, surface mount boxes and panels
14. Modules shall be available in at least ten standard colors
15. Modules shall be provided in colors and quantities needed.
16. Free termination tool shall be supplied with each carton (20 jacks)
17. Approved manufacture and part numbers: Legrand

a. HDJ6-yy (yy=color; sold in qty. of 20)

C. Category 6a Module

1. Module performance rating shall be clearly marked on the front of the module
2. Provide and install 8 position – 8 conductor non-keyed Outlets per drawing
3. Module shall support both T568B & T568A wiring configurations
4. Same module shall be used in faceplate and patch panel
5. Module's circuit traces shall be rated to 1.5 Amps current carrying capacity
6. Module's contacts shall have 50 micro inches of gold plating
7. Module's contacts shall be designed to minimize spark gap erosion
8. Module shall be rear-loading
9. Module must mount to the device using a locking latch for quick reliable mounting and easy, toolless removal while supporting a minimum 50lbs of force retention
10. Module must support a minimum of 35lbs of force retention to the cable at the point of termination.
11. Module shall use lacing cap/crimp termination method
12. Module shall allow color coding via icon designation for each port
13. Module shall work with faceplates, surface mount boxes and panels
14. Modules shall be available in at least ten standard colors
15. Modules shall be provided in colors and quantities needed
16. Free termination tool shall be supplied with each carton (20 jacks)
17. Approved manufacture and part numbers: Legrand

a. HDJ6A-yy (yy=color; sold in qty. of 20)

D. Faceplates

1. Faceplates shall be available with 1, 2, 3, 4, 6, and 12 port options
2. Faceplates shall be available in fog white, cloud white, ivory, gray, and black
3. Faceplates shall have integrated label field
4. Approved manufacture and part numbers: Legrand

a. 403HDJ1x-yy (Single Gang; x=# ports, yy=color)

E. Blanks

1. Blanks shall be provided and installed as needed
2. Blanks shall be available in fog white, cloud white, gray, and black
3. Blanks shall be installed and fastened via the same means as the modules
4. Approved manufacture and part numbers: Legrand

- a. HDJBL10-yy (yy=color; 10 pack)

F. Surface Mount Boxes

1. Surface Mount Boxes shall be available in 1, 2, or 4 port configurations
2. Surface Mount Boxes shall be available in fog white or cloud white
3. Surface Mount Box shall be UL 2043 / plenum rated for 1-port and 2-port configurations
4. Modules shall rear-load into surface mount box
5. Surface Mount Boxes shall mount with provided hardware or adhesive strip
6. Surface Mount Box shall include a label field
7. Modules shall be the same used for faceplates and panels
8. Approved manufacture and part numbers: Legrand

- a. 404HDJx-yy (x = # ports, yy=color)

G. Patch Panels

1. Provide and install patch panels as needed
2. Panel shall be 24 port or 48 port as per drawings
3. Panel shall be unloaded
4. Panel shall be available as flat or angled
5. Must be available in a high-density format allowing for 48-ports in a single rack unit footprint
6. Modules shall rear-load
7. Modules shall flush-mount
8. Angled patch panels shall mount recessed at least 1.4 inches so that the point of the angle is flush with the rack rails
9. Panel shall use same jacks as faceplates and surface mount boxes
10. Modules shall be added as needed with blanks in unused ports
11. Approved manufacture and part numbers: Legrand
 - a. PHDHJU24 (24 port flat panel, 1RU, add "-W" for white)
 - b. PHDHJU48 (48 port flat panel, 1RU, add "-W" for white)
 - c. PSDHJU48 (48 port flat panel, 2RU, add "-W" for white)
 - d. PHDHJU72 (72 port flat panel, 2RU, add "-W" for white)
 - e. PHAJU24 (24 port angled panel, 1RU, add "-W" for white)
 - f. PHAHJU48 (48 port angled panel, 1RU, add "-W" for white)
 - g. PSAHJU48 (48 port angled panel, 2RU, add "-W" for white)

- h. PHAHJU72 (72 port angled panel, 2RU, add "-W" for white)

H. Copper Patch Cords

1. Cords must be available with category 6 and category 6a performance
2. Category 6 / 6a cords shall be compliant with TIA category 6 / 6a channel performance
3. Cords shall be provided to owner at end completion of project.
4. Cords shall be provided in required quantities, lengths and colors
5. Bulk packaging options shall be available.
6. Approved manufacture and part numbers: Legrand
 - a. MC6-YY-XX (XX = color, YYY = length in feet, Cat 6)
 - b. MC6A-YY-XX (XX = color, YYY = length in feet, Cat 6A)
 - c. EZFPMxyyQaa-zz (x = category, yy = length in feet, aa = quantity in package, zz = color)
 - d. EZCxxyQaa-zz (x = category, yy = length in feet, aa = quantity in package, zz = color)

2.4 Fiber Termination Hardware

- A. If a given application requires product(s) outside of this section of the specification to be employed, the premium warranty will apply as long as the chosen product(s) is(are) listed on the nCompass Premium Fiber Cabling System data sheet.
- B. Optical Fiber Enclosures
 1. Fiber enclosures shall provide standard density of 72 LCs per rack unit
 2. Fiber enclosure shall have front doors, rear doors and removable top panels
 3. Fiber enclosures shall have rear openings for horizontal cabling entrances
 4. Fiber enclosures shall accept adapter panels, fiber cassettes, splice cassettes or splice trays.
 5. Fiber enclosures shall be available in 1U, 2U and 4U sizes.
 6. Fiber enclosures shall be equipped with 60/40 removable covers.
 7. Fiber enclosures shall be equipped with mounting ears capable of allowing the enclosure at variable depths relative to the rails of the rack. The lower most and upper most mounting holes on the ears shall be open allowing for screws to be placed in the rack and a single tech to place the enclosure into the rack.
 8. Fiber enclosures shall be provided and installed per drawings
 9. Approved manufacture and part numbers: Legrand
 - a. EQ01U-CHC (1RU Enclosure)
 - b. EQ02U-CHC (2RU Enclosure)
 - c. EQ04U-CVC (4RU Enclosure)
- C. Optical Fiber Adaptor Panels
 1. Adapter panels shall be available with 12 and 24 fiber LC options
 2. Adapter panels shall be available for multimode and singlemode
 3. Approved manufacture and part numbers: Legrand
 - a. OFP-LCD12AC (LC, single-mode, blue, 12 fiber adapter panel)
 - b. OFP-LCQ24AC (LC, single-mode, blue, 24 fiber adapter panel)

- D. Fusion Splice-On Optical Fiber Connectors
1. Optical fiber connectors shall be pre-polished
 2. Optical fiber connectors shall be available with OS2 fiber option
 3. Optical fiber connectors shall terminate on 900 um (micron) cable jacket
 4. Optical fiber connectors shall use a fusion splicing termination method
 5. Optical fiber connectors shall not require epoxy or polishing
 6. Optical fiber LC connectors shall be provided and installed as required
 7. Approved manufacture and part numbers: Legrand
 - a. 205KNF9SA-09 (LC OS2 single-mode fusion splice-on connector, white boot)
- E. Optical Fiber Patch cords
1. Cords shall be TIA channel compliant
 2. All cords shall be made in the USA
 3. Multimode cords shall have performance values aligned with the following values
 - i. Core – 0.50dB maximum insertion loss 19.0dB maximum return loss
 - ii. Ultra – 0.15dB maximum insertion loss 19.0dB maximum return loss
 - iii. Quantum – 0.14dB maximum insertion loss 37.0dB maximum return loss
 4. Single-mode cords shall have performance values aligned with the following values
 - i. Core – 0.30dB maximum insertion loss 52.0dB (UPC) and 55.0dB (APC) maximum return loss
 - ii. Ultra – 0.25dB maximum insertion loss 52.0dB (UPC) and 55.0dB (APC) maximum return loss
 - iii. Quantum – 0.14dB maximum insertion loss 52.0dB (UPC) and 55.0dB (APC) maximum return loss
 5. Cords shall be provided to owner at end completion of project.
 6. Cords shall be LC to LC required quantities and lengths
 7. Cords shall be available as A-A or A-B polarity
 8. Approved manufacture and part numbers: Legrand
 - a. L1, L3, or L4 series

2.5 Racks, Cable Management, Shelves

- A. Items in this section can be substituted with the owner's or owner's representative prior to construction. If these products are substituted, the premium performance warranty will not be affected.
- B. Channel Rack
1. Shall be honeycomb in design to maximize the airflow thru the racks for passive cooling
 2. Shall be available in 7' heights
 3. Shall be available in 10.5" depth
 4. Shall be UL Listed
 5. Shall have static weight capacity of 2000#
 6. Each Rack shall be configurable in both 19" and 23" racks
 7. Shall have both floor and ceiling access for cable distribution
 8. Shall be able configure to sit on 2' x 2' floor tile

9. Shall provide a top patch cable routing with a trough form and waterfall approach to aid in cable routing
 10. Shall have hook and loop straps for securing cables.
 11. Shall have EIA hole pattern on front and rear
 12. Shall be available in both black and white finishes.
 13. Shall be able to accept 4"-16" wide vertical managers
 14. Shall utilize Rack Spacing Bars between the racks for ease in installation
 15. Speednuts shall be used to bolt the rack together in 8 locations
 16. Shall have 12-24 tapped mounting holes for mounting of telecom equipment.
 17. Approved manufacturer part numbers: Legrand
 - a. MM20710
- C. 4-Post Racks for Servers, Monitors, and Keyboards
1. Rails on adjustable racks shall adjust from 12.5" to minimum of 30"
 2. Rails on adjustable racks shall be able to adjust after installation
 3. Shall be able to mount the vertical manager from front or rear
 4. Shall be available in 7' height for adjustable racks.
 5. Shall have #12-24 tapped or 3/8" square holes in the EIA hole pattern on front and rear
 6. Shall include a quantity of 50, #12-24 screws or cage nuts and screws as appropriate
 7. Shall have a static weight capacity of 2000lb.
 8. Shall be made of aluminum
 9. Shall be available in black
 10. Approved manufacture and part numbers: Legrand
 - a. MM20736ADJ12 (45RU, 84" height, adjustable to 36" depth, Tapped #12-24)
 - b. MM20736ADJ38 (45RU, 84" height, adjustable to 36" depth, Punched 3/8 in Square)
- D. Vertical Cable Management
1. Must be available in both black and white to match the color of the racks/cabinets.
 2. Must be manufactured from the same company as the rack/cabinet.
 3. Must be available in 6", 10" 12" and 16" widths.
 4. Must have zero RU cable management managers that will fit inside the VM.
 5. Must have minimum of 4 cable management spools to fit inside managers to aid with fiber slack management
 6. Must have minimum of 12 bend limiting clips to protect the cordage entering the vertical manager.
 7. Approved manufacture and part numbers: Legrand
 - a. MM20VMD7yy (7' height, yy = width)

I. Horizontal Cable Management

1. Horizontal managers shall have fingers for cable management
2. Horizontal managers shall have four 1" x 2" or 1.5" x 2" cutouts
3. Horizontal managers shall have a depth of 7.25"
4. Horizontal managers shall be 1RU, 2RU, 3RU, or 4RU as specified
5. Horizontal managers shall be available in black
6. Horizontal managers shall have a tool-less cover
7. Horizontal managers shall be provided as indicated on drawings
8. Approved manufacture and part numbers: Legrand
 - a. SHMC1RU (1 rack unit)
 - b. SHMC2RU (2 rack unit)
 - c. SHMC3RU (3 rack unit)

 - d. SHMC4RU (4 rack unit)

E. General Purpose Solid Equipment Shelf

1. Shelf shall have 2-point mounting
2. Shelf shall hold up to 75 lbs.
3. Shelf shall be solid
4. Shelf shall be 5.25"H x 17.25"W x 10.13"D
5. Shelf shall be RoHS compliant
6. Shelf shall be provided as indicated on drawings
7. Shelf shall be black
8. Approved manufacture and part numbers: Legrand
 - a. 60400404

F.S standards Vented Equipment Self

1. Shelf shall have 2-point mounting
2. Shelf shall hold up to 50 lbs.
3. Shelf shall have vented tray
4. Shelf shall be 4"H x 17.5"W x 16"D
5. Shelf shall be RoHS compliant
6. Shelf shall be provided as indicated on Drawings
7. Shelf shall be black
8. Approved manufacture and part numbers: Legrand

a. 604045401.

G. Four Point Equipment Shelf

1. Shelf shall use 4-point mounting to support equipment
2. Shelf shall hold up to 200 lbs.
3. Shelf shall have a fixed front flange with an infinitely adjustable rear flange
4. Shelf shall have a slotted tray
5. Shelf shall be 1.75"H x 19"W x 30"D
6. Shelf shall be RoHS compliant
7. Shelf shall be provided as indicated on drawings
8. Shelf shall be black
9. Approved manufacture and part numbers: Legrand

a. 60400538

H. Keyboard/Monitor Shelf:

1. Keyboard/monitor shelf shall accept full size keyboard
2. Keyboard/monitor shelf shall have folding tray
3. Keyboard/monitor shelf shall come equipped for installation of mouse pad tray
4. Keyboard/monitor shelf shall have mounting hardware included
5. Keyboard/monitor shelf shall be 7"H x 19"W x 15.5"D
6. Keyboard/monitor shelf shall be provided as indicated on Drawings
7. Keyboard/monitor shelf shall be Black
8. Approved manufacture and part numbers: Legrand

a. 60400550

2.6 Bonding and Grounding

A. PBB (Primary Bonding Busbar)

1. PBB shall be ¼" thick electrolytic 110 alloy copper bar
2. PBB shall be 12"W x 4"H
3. PBB shall have 12 5/16" hole sets and 6 7/16" hole sets
4. PBB shall include 1-1/2" insulators and 1" off-set stainless steel mounting brackets
5. PBB shall include ½ oz. tube of antioxidant joint compound
6. PBB shall meet ANSI/TIA 607 standards
7. (1) PBB shall be provided and installed in the Main Telecommunication Room.
8. PBB shall be bonded to electrical ground
9. Approved manufacture and part numbers: Legrand

a. GB4X12TMGB

B. SBB (Secondary Bonding Busbar)

1. SBB shall be ¼" thick electrolytic 110 alloy copper bar
2. SBB shall be 10"W x 2"H
3. SBB shall have 4 5/16" hole sets and 3 7/16" hole sets
4. SBB shall include 1-1/2" insulators and 1" off-set stainless steel mounting brackets
5. SBB shall include ½ oz. tube of antioxidant joint compound
6. SBB shall meet ANSI/TIA 607 standards

7. Provide and install (1) SBB in all Telecommunication Rooms (TR) other than the main TR
 8. Bond to grounding system
 9. Approved manufacture and part numbers: Legrand
 - a. GB2X10TGB
- C. Rack Bonding Busbar Kit
1. RBB shall be 1" x 19.25"
 2. RBB shall be 1-1/4" thick electrolytic 110 copper alloy bar
 3. RBB Kit shall have 3" bar splice plate with 2 slotted holes, (2) white delrin insulators, (2) #12-24 x 5/8" hex washer head screws, (2) #12-24 x 3/4" copper flashed brass screws, (2) #2 copper flat washers, (8) #6-32 x 1/4" copper flashed brass screws and (8) #6 ring terminals
 4. Provide and install (1) rack bonding busbar at top of all (2 post and 4 post) equipment racks provided and installed on project.
 5. RBB shall be bonded to the PBB or an SBB
 6. Approved manufacture and part numbers: Legrand
 - a. GBH19KIT
- D. Compression Lugs and Taps
1. Provide and install as needed to bond telecommunications infrastructure equipment to PBB or SBB as required
 2. Approved manufacture and part numbers: Legrand
 - a. As Required

2.7 Firestopping

- A. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly fire stopped.

- B. All smoke walls must be fire stopped using a 1-hour F rated UL system.
- C. Fire stop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed fire stop system, shall be provided to the Owner's Technical Representative prior to installing the fire stop system(s).
- D. All areas that have the fire stop compromised due to MAC work (Moves, Adds and Changes) must be restored to the original rating of the firewall (or floor). It is preferred that the products used in the original UL System are used to restore it. If the UL system will no longer restore that penetration to the original rating, the new system used must be approved by the end user or their owner's representative.
- E. Provide UL systems for the installed UL systems to the end user for proof of proper firestop installation. An example of a proper UL system for a no-maintenance system using the Hilti Speed Sleeve in a gypsum dry wall application for a 2 Hour F rating would be: W-L-3334. This is just an example of the UL systems available for to provide guidance in properly firestopping within the facility.
- F. Provide a firestop rated cable management device whenever cables penetrate fire rated walls that will require frequent cable additions and changes. The fire rated device shall contain integrated intumescent firestop materials.

PART 3 – EXECUTION

3.1 INSTALLATION: GENERAL

- A. Open Cable Support Installation
 - 1. Contractor shall furnish and install all supports for cables specified in this section.
 - 2. Ensure complete raceway system is installed prior to cable installation. At no time shall cables be left unsupported
 - 3. Cable supports shall be spaced randomly, but no further than 5'-0" apart.
 - 4. Provide all additional cable management products, sleeves or conduit raceways as required to protect exposed cabling and complete the installation of cables in a neat manner.
 - 5. All floor penetrations shall be at columns, exterior walls or in equipment rooms.
 - 6. Cables shall be supported at height of bottom flange of structural beams using a rigid support method (i.e. threaded rod, beam clamps, etc.).
 - 7. Do not support cables from ductwork, sprinkler piping, water piping, waste piping, conduit, ceiling wire, or other system supports.
 - 8. Provide independent support system for each low voltage cabling system.

B. Cable Installation

1. All communications cabling that has become abandoned as part of new renovation projects, previous renovation projects, or temporary communication cables used during the construction process shall be completely removed. Abandoned communication cables that may have future use can remain in place if labeled clear at both end and at regular intervals of the cable run. (Refer to NEC Article 800.52 for more information regarding the removal of abandoned communication cables).
2. All cables shall be bundled using plenum rated ties, loosely tied so as not to deform cable, 5'-0" on center (at mid-span).
3. All cabling shall be installed in accordance with manufacturers' written bend radius and pulling tensions. General industry guidelines recommend the following bend radius and pulling tensions:
 - a. Tensile loading on a single 4-pair copper UTP cable shall not exceed 25 lbs.
 - b. Bend radius of a single 4-pair copper unshielded twisted pair cable shall not exceed 4 times the diameter of the cable.
 - c. Bend radius of multi-pair copper unshielded twisted pair and optical fiber cable shall not exceed 10 times the diameter of the cable.
4. All conduits and conduit sleeves shall have bushings or grommets shall be installed prior to the installation of communications cables to avoid damage and abrasions to cable sheathing and insulation. If bushings have been installed by the electrical Contractor, the communications cabling contract shall furnish and install bushings prior to pulling communications cabling.
5. Horizontal cable length for 4-pair copper UTP cables shall not exceed 295 feet. Prior to bidding and installation, the contractor shall review the drawings and verify no cable run exceeds 295 feet and notify the communications designer of cable runs that may exceed 295 feet.
6. Splices are not permitted in any cable unless other specified or show on drawings.
7. Avoid placing copper cables near sources of extreme heat (i.e. boilers, radiators, heat coils).
8. Maintain cable twists for all UTP cables. For terminations cable sheathing shall be stripping back no more than 1/2" back from termination point for all Category 6 cables.
9. All cables shall be supported by cable tray, J-hooks, or cable runway. When cables leave trays or runways, cables shall be supported by drop-outs or cable support hardware manufactured specifically for the purpose of supporting cables. J-hooks shall be installed a minimum of every 5 feet and cabling shall maintain minimal deflection and strain (less than 12" deflection). Cables shall not be supported from ceiling grid wires.
10. Cables shall not run above iron joists.
11. All cables shall be separated and bundled into like groups by cable sheathing colors.
12. Service loops shall be provided at both ends of installed horizontal and backbone cabling. A 12" service loop shall be installed in the ceiling space near workstation outlets (excessive cable shall not be coiled in outlet boxes). A 10' service loop shall be provided in communication rooms and shall be installed to allow for future equipment rack/cabinet relocations without the need to re-terminate patch panels; the 10' service loop shall be neatly routed on cable runway in telecommunication room.
13. Cabling entering equipment rooms shall be neatly installed on cable runway and secured with hook and loop fasteners as need. All cables running vertically on cable runway or in

- racks shall be secured to provide support. Cables shall always be installed vertically/horizontally or at right angles to structure.
14. Hook and loop fasteners are recommended to secure permanently installed horizontal and backbone cabling; all cable fastening methods installed in plenum ceiling spaces shall be rated for use in plenum spaces. Hook and loop fasteners shall never be secured too tight whereby potentially changing the cable integrity.
 15. Separation: Maintain the following distances between cables, other system cables and other building systems:
 - a. One (1) foot from fluorescent lights.
 - b. Four (4) feet from motors and transformers
 - c. Three (3) feet from hot water piping or other mechanical equipment.
 - d. One (1) foot from electrical conduits, other systems cables or other electrical equipment.
 16. All low voltage cables shall be run parallel or at right angles to building structural framework. Do not run cables diagonally across ceiling space without written authorization by the Architect's Electrical Engineer.
 17. Fire seal around all cables running through rated floors and walls. UL Systems should be contained in the submittal and available for review by building inspection.
 18. H- straps included with rack shall be utilized in telecommunications rooms for all cable bundling.
 19. Plastic/ nylon tie wraps shall be prohibited at any time.
 20. Leave spare pull string with every outlet installed.
 21. All cabling that has been shipped or stored in an environment consistent with the manufacturer's guidelines.
 - a. Cabling that has come in contact with chemicals must be discarded. Premise cabling that has been exposed to water must be discarded.
 - b. Cabling stored outside of the recommended temperatures must be allowed to return to proper temperature prior to installation.
 22. All cables installed in underground conduit, conduit under slab on grade, or direct buried must be rated by the manufacturer for wet locations.
 23. Paint over spray, or other liquids used in the construction process, on telecommunications cables will be cause to void the ability to provide nCompass Premium Limited Lifetime Warranty as required.
 - a. Coordinate with general contractors, painters and other trades so all are clear that NO cables shall have paint over spray or other chemicals on them.
 - b. Protect installed cables at all times.

3.2 INSTALLATION: COMMUNICATIONS INFRASTRUCTURE

- A. Category 6 Horizontal Cables:
 1. Maximum cable lengths to be 295 feet (90 m) including service loop. Provide all necessary installation materials, tools and equipment to perform insulation displacement type terminations at all communications outlets, patch panels and 110 punch-down blocks.
 2. Support and secure cables at patch panels using rear cable management bracket supplied with panel.

3. Install stuffer caps on each workstation outlet and patch panel port after cable has been terminated on 110 IDC.

B. Optical Fiber Cable:

1. All optical fiber installations shall be installed using open cabling methods. Limit cable-bending radius to 20 times the cable diameter during installation, and 10 times the diameter after installation, or per manufacturer's guidelines, whichever is larger. Provide all required tools, materials, consumables, and equipment necessary for cleaning and field termination of optical fiber connectors. Label each end of each cable as to source and destination. Terminate optical fibers in consistent, consecutive manner at each end. Label Optical Fiber raceway cable with yellow "Caution Optical Fiber Cable" tags every 10 feet. Leave 10 feet of slack at each fiber termination point. Neatly coil slack optical fiber cable on top of rack above optical fiber patch and splice enclosure at each rack location.
2. During installation of optical fiber cable do not allow pulling tension to exceed cable manufacturer's specification for the cable being installed. Only the strength member of the cable shall be subjected to the pulling tension.
3. All optical fiber connector tips shall be cleaned with proper cleaning tools specifically designed for optical fiber prior to inserting them into adaptor panels.

C. Racks and Enclosures:

1. Freestanding equipment racks and enclosures shall be protected free of all dust, debris and other environmental elements during construction until substantial completion walk-through.
2. Secure all racks and enclosures to floor using 1/2" hardware.

3.3 INSTALLATION OF WIRELESS LAN SYSTEM

A. Wireless Access Point Cabling

1. Install 20' cable coil to allow for final placement of access point.
2. Terminate cable with Cat 6A module and surface mount box
3. Label for identification

3.4 LABELING

A. General:

1. All labels shall be permanent, machine generated labels produced by a labeling machine.
2. Labeling information will be reviewed at Pre-Install Meeting, and the Owner shall approve the labeling scheme prior to the installation of any cabling.
3. Surfaces shall be cleaned before attaching labels. All labels shall be attached firmly and vertically plumb on equipment, faceplates, patch panels termination blocks, etc.
4. All labeling of cables, equipment, and components shall be included in as-built documentation, floor plan drawings, and schematic designs.

B. Cabling

1. All structured cables (horizontal and backbone) shall be labeled at both ends within 6" of cable termination point. Where voice backbone cables extend behind termination blocks, cable labels shall be placed at a location on the cable where the labels are visible from the front of the termination blocks.
2. Labels shall have an adhesive backing and shall wrap completely around the circumference of the cable jacket. Label and lettering sizes shall be of appropriate size in regards to cable diameter.

C. Labeling of Telecommunications Room, Equipment Racks, Termination Hardware, and Faceplates

1. Telecommunications Room shall be labeled clearly on the inside to identity what number it is.
 - a. Label will be three (3) characters ex "TR2"
 - 1) First two (2) characters shall be TR for telecommunications room
 - 2) Third character shall be a number for what TR it is.
 - b. Three (3) labels shall be place
 - 1) On first visible rack entering TR. 1" tape shall be used.
 - 2) On the PBB or SBB. 1/2" tape shall be used
 - 3) On door inside of TR. 1/2" tape shall be used.
2. Equipment racks and cabinets are NOT required to be labeled.
3. Fiber Enclosures shall be labeled with 1/2" tape on the front of the enclosure.
 - a. Label will be one (1) character
 - 1) Character will be an alpha character i.e. "A"
 - b. Place two (2) labels on the front of each fiber enclosure.
 - 1) One on the left and one on the right. Both centered vertically.
4. Copper Patch Panels shall be labeled with 1/2" tape on the front of the panel.
 - a. Label will be one (1) character
 - 1) Character will be an alpha character i.e. "A"
 - b. Place two (2) labels on the front of each patch panel.
 - 1) One on the left and one on the right. Both centered vertically.
5. Faceplates: Work Station Outlets shall be labeled with 3/8" tape on the front of the faceplate.
 - a. Label for each module will be four (4) character i.e. 2B14
 - 1) First character will be a number that represents the TR that the cable goes to i.e. "2"
 - 2) Second character will be a letter that represents what patch panel the cable is terminated on i.e. "B"
 - 3) The last two characters will be numbers representing the patch panel port the cable is terminated on. i.e. "14"
 - b. All modules in a faceplate shall be labeled with their own unique ID.
6. Voice Termination 110 Blocks shall be labeled similar to patch panels. Voice backbone cable pairs shall be labeled starting with V001 starting at the main communications room and continuing sequentially through all communications rooms.

3.5 Field Testing and Cable Certification

- A. The following criteria must be met before certification testing can begin.
 - 1. In new construction, the above ceiling work of all trades shall be 90% complete.
 - 2. Work within the TR must be substantially complete. Only troubleshooting of cabling should occur in proximity of cables that have been tested
 - 3. Terminations must be complete and in their final positions. Dust caps must be installed on both ends of the termination and faceplates in place
 - B. Each permanent link or channel in the network must be field tested in accordance with the TIA-568 series industry standard AND nCompass testing requirements in force at the time of purchase (nCompass testing requirements take precedence over TIA when differences exist). The installed permanent links and channels must have passed all applicable TIA and nCompass performance requirements. Minimum testing for copper systems includes Wire Map, Length, Attenuation, Near End Crosstalk, Far End Crosstalk, Return Loss, PS NEXT, ELFEXT, and PS ELFEXT. Minimum testing for Fiber Optic links includes horizontal and backbone, Bi-Directional, Dual Wavelength, Insertion Loss and Length.
 - 1. Field terminated plugs shall be tested in a permanent link configuration with the appropriate test equipment for field terminated plugs.
 - C. Permanent Link Testing shall be completed on all horizontal (station) cables as a minimum requirement.
 - D. If certifying using Channel Testing, patch cords used for the channel test must remain in the channel. They cannot be moved to another channel.
 - E. Submit test reports to the General Contractor prior to active equipment installation.
- F. Category 6/6a Cable Testing:
- 1. All wiring shall be certified to meet or exceed the specifications as set forth in TIA/EIA-568C for Category 6/6a requirements for permanent link or channel.
 - a. Shall be tested with a level V accuracy tester (See approved tester list on the DAT contractor dashboard)
 - b. Tester shall be factory calibrated within the last 12 months at time of use.
 - 2. Field Testing shall include the following parameters for each pair of each cable installed:
 - a. Store number and name
 - b. Test equipment manufacturer and model number
 - c. Cable I.D. The test sheets will be in numerical order by cable ID
 - d. Date of test
 - e. Wire map (pin to pin connectivity and polarity check) i.e. near 12345678, far 12345678
 - f. Length (in feet)
 - g. Insertion Loss
 - h. Near End Crosstalk (NEXT)
 - i. Power Sum Near End Crosstalk (PSNEXT)
 - j. Equal-Level Far End Crosstalk (ELFEXT)
 - k. Power Sum Equal-Level Far End Crosstalk (PSELFEXT)
 - l. Return Loss
 - m. Delay Skew

- n. Attenuation to Crosstalk ratio (ACR)
 - o. DC Resistance per 100M/328 feet
 - p. Impedance
 - q. Capacitance
3. Record test results for each cable and turn over to the General Contractor two weeks prior to occupancy. Correct malfunctions when detected, and re-test to demonstrate compliance.

G. Optical Fiber Testing:

- 1. Pre-installation Testing:
 - a. Test each strand of every optical fiber cable on the reel with a light source and a power meter. Obtain the cable manufacturer power meter test results for each reel used on the project. Prior to completion of project, turn over the completed optical fiber test form, optical fiber cable reel ID tags and optical fiber cable manufacturer's test results.
- 2. Acceptance Testing:
 - a. After terminating optical fiber cables the system shall be tested using Tier 1 test format. Tier 1 testing is mandatory. Tier 2 testing, (OTDR testing), is optional.
 - b. Multimode optical fiber attenuation shall be tested on all individual fibers of each cable segment with an nCompass approved field certification tester.
 - 1) Encircled Flux Compliant as required by TIA-526-14-B. Source shall be EF compliant. Matched test reference cords per TIA TSB-4979.
 - 2) 1 Jumper reference method shall be used.
 - 3) Verification of test reference cords are required and shall be stored automatically as part of test data.
 - 4) 850/1300 nm wave lengths shall be tested on all fibers.
 - 5) Bi-directionally
- 3. Test Results: Must be completed and turned over to the General Contractor prior to active equipment installation. Specific due dates for optical fiber will be established at pre-install meeting.
- 4. The Warranty Submittal must be completed online within 30 days of installation completion. Copies of all certification test reports must be submitted as part of the Warranty Submittal. Test results must be kept on file by the registrant to be resubmitted when requested by Supplier. Data must be saved and submitted in raw data and summary formats (in tester's original format). The test data shall be submitted via online upload to contractor website. If online upload is unsuccessful, the data can be submitted via e-mail or disc.

3.6 Cleanup

- A. The communications Contractor shall clean up all debris related communications cabling installation on a regular basis. Protect all equipment from damage during construction. Equipment not protected shall be replaced at the Contractor's expense.
 - 1. Only gentle cleaning products should be used and all cleaners shall be approved for use for the given product. NO liquid cleaners shall come in contact with premise cables.

2. If the communications contractor is not physically performing the clean, they are responsible for providing oversight to ensure integrity of the warranty.

END OF SECTION

SECTION 281000 ACCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access control system requirements.
- B. Access control units and software.
- C. Access control point peripherals, including card readers and keypads.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware: Electrically operated door hardware, for interface with access control system.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260533.13 - Conduit for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 282100 - Video Surveillance Cameras: For interface with access control system.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 294 - Access Control System Units Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other installers to provide suitable door hardware as required for both access control functionality and code compliance.
 - 2. Coordinate the placement of readers with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 3. Coordinate the work with other installers to provide power for equipment at required locations.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meetings:
 - 1. Conduct meeting with facility representative to review reader and equipment locations.
 - 2. Conduct meeting with facility representative and other related equipment manufacturers to discuss access control system interface requirements.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- D. Design Data: Standby battery/UPS calculations.
- E. Certify that proposed system design and components meet or exceed specified requirements.

- F. Evidence of qualifications for manufacturer.
- G. Evidence of qualifications for installer.
- H. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- I. Manufacturer's detailed field testing procedures.
- J. Maintenance contracts.
- K. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.
- L. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- M. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- N. Software: One copy of software not resident in read-only memory.
- O. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70.
 - 2. The requirements of the local authorities having jurisdiction.
 - 3. Applicable TIA/EIA standards.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with access control systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 ACCESS CONTROL SYSTEM REQUIREMENTS

- A. Provide new access control system consisting of required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

- B. Basis of Design: Johnson Controls C*CURE 9000 and iSTAR.
- C. Surge Protection:
 - 1. Provide surge protection for readers and door strikes/locks.
 - 2. Provide equipment power surge protection where electrical distribution system surge protection is not provided.
- D. Access Control Points:
 - 1. See door hardware schedule and Security System drawings for locations and requirements.
- E. Computers Required:
 - 1. Coordinate with owner for locations and requirements.
 - 2. Workstation Computer(s):
 - 3. Badging Station Computer(s):
- F. Interface with Other Systems:
 - 1. Provide products compatible with other systems requiring interface with access control system.
- G. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 1. Access Control Units and Readers: Listed and labeled as complying with UL 294.

2.02 ACCESS CONTROL UNITS AND SOFTWARE

- A. Provide access control units and software compatible with readers to be connected.
- B. Unless otherwise indicated, provide software and licenses required for fully operational system.

2.03 ACCESS CONTROL POINT PERIPHERALS

- A. Provide devices compatible with control units and software.
- B. Provide devices suitable for operation under the service conditions at the installed location.
- C. Readers and Keypads:
 - 1. General Requirements:
 - a. Provide readers compatible with credentials to be used.
 - b. Color: To be selected by Architect from manufacturer's available standard colors.
 - c. Contactless Smart Card Readers:
 - 1) Utilize 13.56 MHz RF communication with compatible credentials.
 - 2) Utilize 64 bit authentication keys.
 - 3) Support ISO compliant credentials.
 - 4) Support data encryption.
 - d. Proximity Readers:
 - 1) Utilize 125 kHz RF communication with compatible credentials.
 - e. Bluetooth Low Energy (BLE) Readers:
 - 1) Utilize 2.4 GHz RF communication with compatible mobile devices.
- D. Door Locking Devices (Electric Strikes and Magnetic Locks): Comply with Section 087100.

2.04 ACCESSORIES

- A. Provide components as indicated or as required for connection of access control system to devices and other systems indicated.
- B. Unless otherwise indicated, credentials to be provided by Contractor.
 - 1. Provide credentials compatible with readers and control units/software to be used.
- C. Provide cables as indicated or as required for connections between system components.
- D. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install access control system in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Wiring Method: Unless otherwise indicated, use cables (not in conduit).
 - 1. Use suitable listed cables in wet locations, including underground raceways.
 - 2. Use suitable listed cables for vertical riser applications.
 - 3. Use listed plenum rated cables in spaces used for environmental air.
 - 4. Install wiring in conduit for the following:
 - a. Where required for rough-in.
 - b. Where required by authorities having jurisdiction.
 - c. Where exposed to damage.
 - d. Where installed outside the building.
 - e. For exposed connections from outlet boxes to devices.
 - 5. Conduit: Comply with Section 260533.13.
 - 6. Conceal cables unless specifically indicated to be exposed.
 - 7. Use power transfer hinges complying with Section 087100 for concealed connections to door hardware.
 - 8. Route exposed cables parallel or perpendicular to building structural members and surfaces.
 - 9. Do not exceed manufacturer's recommended maximum cable length between components.
- D. Provide grounding and bonding in accordance with Section 260526.
- E. Identify system wiring and components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Prepare and start system in accordance with manufacturer's instructions.
- C. Program system parameters according to requirements of Owner.
- D. Test for proper interface with other systems.
- E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. See Section 017900 - Demonstration and Training, for additional requirements.

- C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.
- D. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of four hours of training.
 - 3. Instructor: Manufacturer's authorized representative.
 - 4. Location: At project site.

3.06 PROTECTION

- A. Protect installed system components from subsequent construction operations.

3.07 MAINTENANCE

- A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of access control system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

3.08 APPENDIX

- A. See attached for Johnson Controls C*CURE 9000 and iSTART information.

END OF SECTION 281000

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C•CURE 9000 and iSTAR Cybersecurity Overview

White Paper

Version 2.0

C•CURE 9000 v2.80

iSTAR v6.7

February 2020



Introduction



C•CURE 9000 provides peace of mind to our customers with a holistic cyber mind-set beginning at initial design concept, continues through product development, and is supported through deployment, including a rapid incident response to meet the comprehensive and evolving cybersecurity environments.

Legal disclaimer

The cybersecurity practices described in this guide are recommended practices to facilitate the secure installation and configuration of the products described herein. However, Johnson Controls cannot guaranty that the implementation of the cybersecurity practices or recommendations described in this guide will ensure the security of the relevant product or system, or prevent, or alter the potential impact of, any unauthorized access or damage caused by a cybersecurity incident. This guide is provided “as is”, and Johnson Controls makes no representation or warranty, express or implied, as to the efficacy of the cybersecurity practices or recommendations described in this guide. Johnson Controls disclaims all liability for any damages that may occur as a result of, or despite, reliance on this guide or compliance with any cybersecurity practices or recommendations set forth herein.

Executive summary

C•CURE 9000 and the iSTAR panels are versatile and secure Johnson Controls access control products. Adopted by government and critical infrastructure sites, financial, medical, and education institutes, C•CURE 9000 and the iSTAR panels have many certifications and security audits.

The encryption between C•CURE 9000 and the iSTAR Ultra and iSTAR Edge control panels has achieved FIPS 140-2 and FIPS 197 validation. When in FIPS-approved or “dark” mode, the iSTAR panels disable all access except direct communications from C•CURE 9000.

Both C•CURE 9000 and the iSTAR panels are developed under a Secure Development Life Cycle that includes secure coding techniques, strict source code control, regular vulnerability and penetration testing, and vulnerability management. When vulnerabilities are discovered after deployment, the cross-functional Cyber-Response team can provide a response the same day.

C•CURE 9000 and the iSTAR panel offer a secure platform that you can customize to meet the security policies of almost any installation and comes with a dedicated support team to address vulnerabilities and other security issues as they arise. This document serves to answer many of the frequently asked cybersecurity questions and identify some of the many security features available in C•CURE 9000 and the iSTAR panels. If questions or issues do arise, contact your Software House representative.

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Our Product Security Program: Firmly established, always evolving.

Johnson Controls creates products and solutions in a culture focused on cyber resilience and we deploy with dedicated support. Our customers benefit from our proven approach:

- Consistent, organization-wide focus.
- Time-tested policies and practices.
- Global knowledge base.
- Support from design through deployment and beyond.
- Continuing investment to meet ever-evolving challenges and needs.

Structured methodology – Because disruption is not an option



Your facility's systems are crucial to continuing operations and maintaining profitability. Johnson Controls takes a holistic, structured approach to help you protect systems and sensitive data from the risk of a cyber-attack.



Disciplined governance. Our Product Security Team employs global governance to put cyber resilience at the forefront. We pursue and continually improve a disciplined, policy-driven approach.



Expert-driven design. Engineering teams are trained in cybersecurity and in designing solutions that support compliance. Cybersecurity experts with certifications including, CISSP, CSSLP, CEH, and CCSP validate designs using up-to-the-minute best practices.



Security-infused development. We work to uncover, remediate and protect against concerns long before product release, through in-house testing that includes the integration of security tooling throughout the development lifecycle.



Knowledge-driven deployment. Through customer education, compliance assistance, security documentation, and our pragmatic approach, we help to facilitate more secure installation.



Lifecycle management. Cybersecurity continues to change, so our security approach goes beyond development and deployment to address tomorrow's concerns as they arise.



Rapid response. Our dedicated cybersecurity team emphasizes speed, transparency and professionalism. We monitor trends, assess new threats and provide guidance on handling vulnerabilities and reducing exposure.

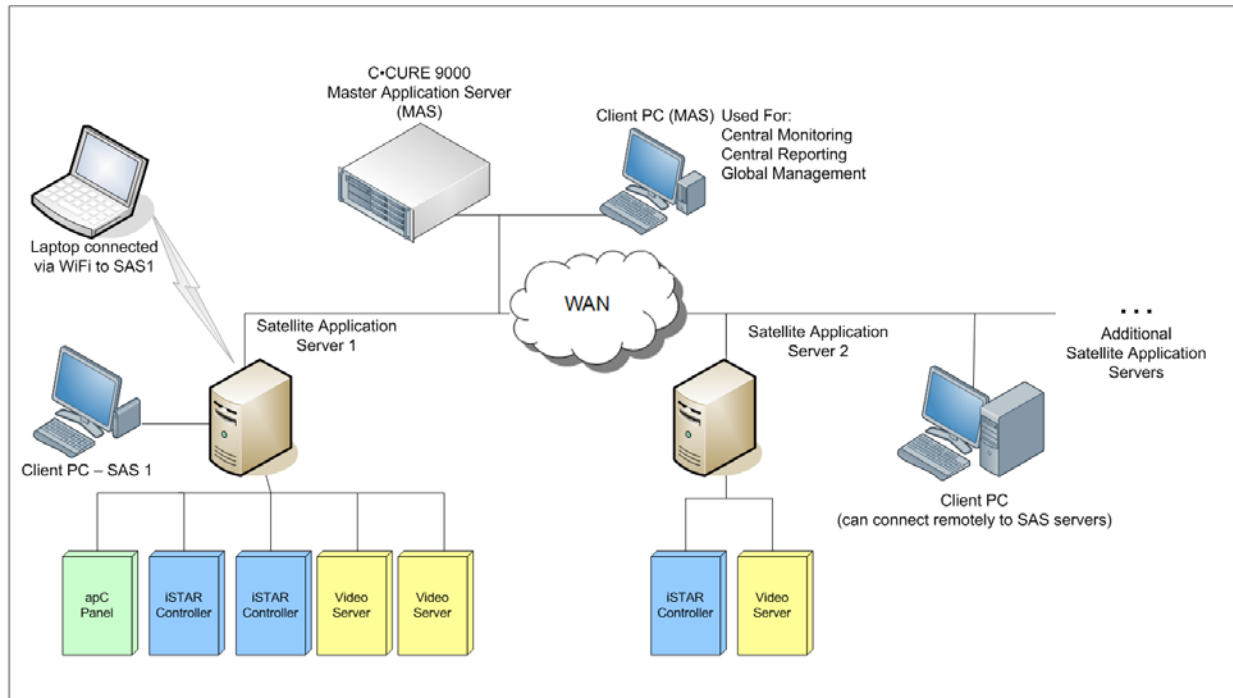


Commitment to partnership. Johnson Controls is dedicated to sharing your responsibility for more secure systems. We support you through education, engagement and thought leadership for greater success in achieving your mission.

The C•CURE 9000 system

Architecture overview

Figure 1



C•CURE 9000 is a flexible, object-oriented security and event management system that features a variety of customizable interfaces for maintaining the system, and for monitoring the sites that you want to secure.

C•CURE 9000 provides extensive information management capability using Microsoft SQL Server and Microsoft .NET Framework V4.6.1. Its distributed client-server architecture is capable of supporting a large array of clients, controllers, and input devices, including various card readers and cameras.

C•CURE employs two thick clients. The Administration Station manages the customized C•CURE 9000 functions, objects, and views of the Monitoring Station. The Monitoring Station tracks events and status of devices, and can control manual actions such as locking and unlocking doors, depending on configuration and operator privileges.

The iSTAR panels are the hardware controllers that interface with access control card readers, locks, and other physical security hardware. They may be configured into clusters with a single master controller communicating to the iSTAR host and store a local version of the access control database so they can continue to operate during a network failure.

Enterprise architecture

C•CURE 9000 Enterprise Architecture is a licensable option that allows you to configure multiple C•CURE 9000 servers to communicate with a Master Application Server (MAS). MAS provides a platform for global management of the Personnel, Video, and access security objects on two or more Satellite Application Servers (SAS) in an enterprise system.

MAS contains the global data that is used across every server, such as global Personnel records, global Clearances, and global Operators. The global data is synchronized to each SAS so that it can be used to implement enterprise-wide security.

The MAS itself does not have any directly connected controllers or video servers, but it can be used to remotely monitor and manage controllers and video servers attached to SAS machines in the enterprise. The MAS provides the capability for Central Monitoring of the entire enterprise, using the C•CURE 9000 Monitoring Station application. You can view Events, Activities, and status of each SAS in the enterprise from a central Monitoring Station connected to the MAS. Alternatively, you can connect to a particular SAS to monitor that system and its connected hardware. In addition, the MAS provides a Central Reporting capability, because its database includes information about all objects that are replicated from the satellite servers.

Each Satellite Application Server contains database records for the video and access security hardware connected to it, in addition to local personnel, clearances, privileges, and other data. Each SAS synchronizes with the MAS so that SAS local data is replicated to the MAS for central management and monitoring.

All data is synchronized immediately when saved (or queued if a server is offline), except for Journal and Audit data, which is synchronized on a configurable schedule.

Note: Network latency and load on the MAS and SAS databases can affect synchronization performance.

Operator Privileges are used to provide system users with access to the information they need, and deny access to information they do not need or should not be able to view.

These capabilities let you deploy multiple C•CURE 9000 servers in an enterprise environment, solving scalability and wide area network issues and providing a platform for central monitoring, global management, and central reporting.

Microsoft Windows operating system

The licensed capabilities of C•CURE 9000 corresponds to the specific version of the Windows operating system it is installed upon. As the host environment, Windows

provides the underlying foundation for configuring a secure C•CURE 9000 system. Tools such as Microsoft Security Configuration Manager, Security Compliance Manager and Windows domain policies can be used to optimize the security of the system.

Additionally, the roles and responsibilities assigned to each C•CURE 9000 user is dependent on the specific Windows operator. This allows user credentials and access to the system to be controlled through Windows Active Directory.

Robustness

Backup/Restore

C•CURE 9000 uses three databases that you can back up at any time using the System Backup feature.

- The Core database is a core component of the management platform upon which C•CURE 9000 is built. It is the central repository for configuration details describing objects created, monitored, and maintained in C•CURE 9000.
- The Audit Log provides a history of changes to configurations managed by C•CURE 9000.
- The Activity Journal maintains a record of activity monitored by the system. Records in the Activity Journal provide a historical view of activity that has occurred within the system, statistical information on resource usage, and personnel and asset location information.

In the event of a system failure or corruption of the Core, Audit Log or Activity Journal database, you can restore one or more of these databases from a backup of the respective database.

The C•CURE 9000 Server Configuration Application Guide describes the details for performing system backup and restore.

User access to the System Backup feature is controlled through the user configuration.

Access control

Authentication

C•CURE 9000 is designed for deployment in an Active Directory domain environment utilizing Windows Single Sign-On (SSO) to integrate login credentials with operator permissions. This provides a seamless user authentication and authorization process. Password rules and policies such as predefined number of login attempts, character

length, combination of alpha numeric, and user-defined lockouts are managed by the local Microsoft Windows operating system or the domain controller. C•CURE 9000 does not store or have any visibility of the credentials.

Separation of responsibilities

C•CURE 9000 has highly configurable operator privilege functionality. Using the Privilege Editor feature, administrators can specify the objects, programs, reports, Personnel, events, and actions that Operators can view and use. The feature also allows for exceptions and bulk configuration.

Figure 2

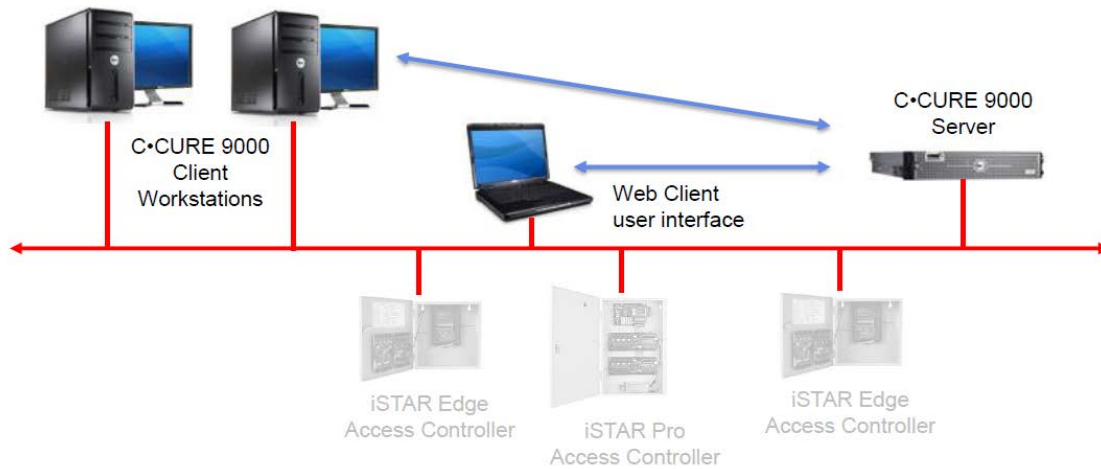
The screenshot displays the 'Classes' pane on the left and the 'Permissions' table on the right. The 'Classes' pane shows a tree structure with 'apC Door' selected. The 'Permissions' table lists various actions and their corresponding 'Grant' status.

Permissions	Grant
No Access	<input checked="" type="checkbox"/>
Read	<input type="checkbox"/>
Edit	<input type="checkbox"/>
New	<input type="checkbox"/>
Delete	<input type="checkbox"/>
Set property	<input type="checkbox"/>
Add to group	<input type="checkbox"/>
Export selection	<input type="checkbox"/>
Find in Audit Log	<input type="checkbox"/>
Find in Journal	<input type="checkbox"/>
Monitor	<input type="checkbox"/>
Lock	<input type="checkbox"/>
Unlock	<input type="checkbox"/>
Momentary Unlock	<input type="checkbox"/>
Show Locked Causes	<input type="checkbox"/>
Turn Maintenance Mode On	<input type="checkbox"/>
Turn Maintenance Mode Off	<input type="checkbox"/>

Communication protection

C•CURE 9000

Figure 3



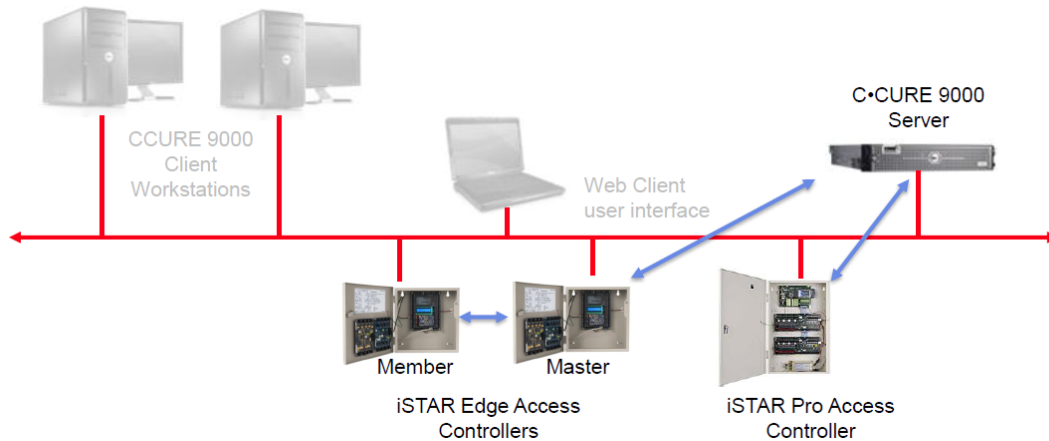
Communication between the C•CURE 9000 server, iSTAR controller, database, or client devices uses the Crossfire service. By default, the CrossFire server uses AES-256 encryption that has been FIPS 197 validated.

(Line 2857): <http://csrc.nist.gov/groups/STM/cavp/documents/aes/aesval.html>

iSTAR

In standard mode, the iSTAR Edge and iSTAR Ultra use TLS to communicate securely with the host and other cluster members. The encryption is FIPS 197 listed (AES 256).

Figure 4



In FIPS mode, the iSTAR will use TLS to authenticate the controller to the C•CURE 9000 host. The system may be set up to use a default certificate, or it may be set up to use a custom certificate provided by a third-party or auto-generated by the C•CURE 9000 host.

- Controller-Based Encryption Mode – C•CURE 9000 creates the Host and CA certificates at the C•CURE 9000 host computer and then directs the iSTAR encrypted controller to generate new public and private keys.
- Host Based Encryption Mode – C•CURE 9000 creates the Host, Controller, and CA certificates on the host computer and then downloads the Controller public key, the Controller private key and the CA certificate to the iSTAR controller. Host-Based Encryption allows the use of a certificate created by a third-party certificate authority.

The default asymmetric encryption is RSA 1024, but may be changed to ECC 571 at the cluster level. The symmetric key remains AES 256.

The iSTAR Edge and iSTAR Ultra are tested and listed for FIPS 140-2 level 2 for cryptographic modules:

- iSTAR Edge: FIPS 140-2 certificate #2309
- iSTAR Ultra: FIPS 140-2 certificate #2315

<http://csrc.nist.gov/groups/STM/cmvp/documents/140-1/140val-all.htm>

Also, in FIPS approved mode, the iSTAR controller disables all ports except those required for communication between the C•CURE 9000 host and other iSTARs in FIPS approved mode. It only accepts communication from the C•CURE 9000 host and the iSTARs in its cluster.

The iSTAR Ultra family supports TLS v1.2 only at minimum.

iSTAR operating system

The iSTAR Ultra family operating systems are Linux-based.

The embedded web server has been developed internally and may be turned off through the controller's setup screen.

Firmware updates

Firmware downloads are issued from the Monitoring Application or a separate utility called ICU utilizing TCP port 1999. The panel continues to operate during the firmware download process. When the panel receives the proper check-sum, this signifies a successful download. The controller must reboot when a successful download is completed. After a successful reboot the server re-establishes communication issuing a fresh personnel and configuration download to the panel. If the panel does not receive the proper checksum then the panel continues to use the previously stored firmware.

iSTAR database

The iSTAR downloads three specific data sets that allow it to operate and make access control decisions: cardholder data, configuration data, and firmware. When a controller is first placed online, the C•CURE 9000 iSTAR driver downloads all pertinent data to that panel. The fast personnel download and the configuration download take place at this time. The fast personnel download uses TCP port 2801. It creates a single file of all personnel data that have access privileges to any of the doors associated with the panel being placed online. All additional incremental system changes regarding cardholder or hardware configurations get downloaded in real-time. Major personnel changes implemented at the server cause the system to perform a fast personnel download to the panels that are affected.

By default the database on the iSTAR is encrypted with AES 256. However, if additional security is required, activating the CPNI mode on the iSTAR Ultra prevents the database from being stored in persistent memory.

ICU now redirects requests to edit any controller configuration setting such as IP address or Host IP, or downloading firmware back to the controller's local web page where editing can take place in a much more secure environment.

The web diagnostics user interface on the iSTAR provides the option to encrypt the main partition of the SD card (OS, access control FW, and customer DB). After the encryption process is finished, the panel boots up normally and continues operation without delay or configuration loss. And in C•CURE 9000 v2.80, you can display the Encrypted Status of each panel. Note that a unique key is used for encryption, so it is no longer be possible to change just the SD card on an iSTAR Ultra.

Enforced unique, strong password, for each controller, for the web diagnostics page. Web passwords must be changed upon initial controller boot up, and, you can change and manage this centrally through C•CURE 9000 v2.80.

Tamper detection

All iSTARs include tamper detection. If the enclosure has been opened an alarm is activated. The iSTAR Ultra includes an optional installation of a back tamper it case it is removed from the wall.

iSTAR Ultra and iSTAR Edge have been FIPS 140-2 approved to provide physical protection of the encryption module. This includes the metal enclosure, physical tamper, preventing visibility, and using tamper evident labels.

Security approvals and certifications

FISMA

You can configure the C•CURE 9000 system to support the controls necessary for overall FISMA compliance. These controls include:

- Authenticated system access.
- Account login/logout management.
- Role-based separation of capabilities, permissions, and privileges.
- System event and configuration change auditing, alerting, and management.
- Restriction of ports, protocols, and services to only those required to support C•CURE 9000 functionality.
- Encrypted communications.

FICAM FIPS-201 certified/GSA approved products lists

The Software House C•CURE 9000 has been tested and certified as an end-to-end physical access control system with high assurance readers and validation software. The system has been tested and approved as a fully compliant FICAM Solution by the U.S. General Services Administration. The approval means that the C•CURE 9000, high assurance readers and validation software meet the rigorous testing requirements and comply with the FICAM roadmap and the realignment of the GSA's Approved Product List (APL). The system was subjected to numerous tests to ensure that the system is not prone to denial of service, credential spoofing, or other types of unauthorized access that could compromise the security of the system. C•CURE 9000 provides a solution for HSPD-12 / FIPS-201 and 800-116 compliance for smart card credentials, along with support for PIV-I, PIV-C, TWIC and the DOD CAC credential using authentication software with its Server-based Certificate Verification Protocol (SCVP) client.

FIPS 197

C•CURE 9000 and the iSTAR Controllers have been certified by the NIST CMVP as meeting the requirements of FIPS 197 AES encryption algorithm standard.

FIPS 140-2

The C•CURE 9000 iSTAR Edge and Ultra controller models have been certified by the NIST CMVP as meeting the requirements of FIPS 140-2 Level 2.

APPENDIX – Resources and references

Johnson Controls documents

The following documents are available at <https://www.johnsoncontrols.com/cyber-solutions>

- C•CURE 9000/iSTAR Port Assignments
- C•CURE 9000/iSTAR FISMA-Ready Compliance Guide
- C•CURE 9000 v2.80/iSTAR NERC-CIP v6 Compliance Guide

Laws and regulations

- Federal Information Security Management Act of 2002
- Federal Information System Modernization Act of 2014
- Consolidated Appropriations Act of 2005, Section 522.
- USA PATRIOT Act (P.L. 107-56), October 2001.

OMB circulars

- OMB Circular A-130, Management of Federal Information Resources, November 2000.
- OMB Memorandum M-05-24, Implementation of Homeland Security Presidential Directive (HSPD) 12—Policy for a Common Identification Standard for Federal Employees and Contractors, August 2005.
- OMB Memorandum M-06-16, Protection of Sensitive Agency Information, June, 2006.

FIPS publications

- FIPS PUB 199, Standards for Security Categorization of Federal Information and Information Systems
- FIPS PUB 200, Minimum Security Requirements for Federal Information and Information Systems

NIST publications

- NIST 800-18, Guide for Developing Security Plans for Information Technology Systems
- NIST 800-26, Security Self-Assessment Guide for Information Technology Systems
- NIST 800-30, Risk Management Guide for Information Technology Systems
- NIST 800-34, Contingency Planning Guide for Information Technology Systems

- NIST 800-37, Guide for Applying the Risk Management Framework to Federal Information Systems: A Security Life Cycle Approach
- NIST 800-47, Security Guide for Interconnecting Information Technology Systems
- NIST 800-53 Rev3, Recommended Security Controls for Federal Information Systems and Organizations
- NIST 800-53A Rev1, Guide for Assessing the Security Controls in Federal Information System and Organizations
- NIST 800-60 Rev1, Guide for Mapping Types of Information and Information Systems to Security
- NIST 800-63, Electronic Authentication Guideline: Recommendations of the National Institute of Standards and Technology
- NIST 800-64, Security Considerations in the Information System Development Life Cycle
- Framework for Improving Critical Infrastructure Cybersecurity

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**SECTION 282100
VIDEO SURVEILLANCE CAMERAS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Video surveillance system requirements.
- B. Video recording and viewing equipment.
- C. Cameras.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 271000 - Structured Cabling: Data cables for IP video surveillance system network connections.
- E. Section 281000 - Access Control: For interface with video surveillance system.
- F. Section 283111 - Building Intrusion Detection: For interface with video surveillance system.

1.03 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices current edition.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 303 - Standard for Installing and Maintaining Closed-Circuit Television (CCTV) Systems 2019.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of cameras with structural members, ductwork, piping, equipment, luminaires, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
 - 2. Coordinate the work with other installers to provide power for cameras and equipment at required locations.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Preinstallation Meetings:
 - 1. Conduct meeting with facility representative to review camera and equipment locations and camera field of view objectives.
 - 2. Conduct meeting with facility representative and other related equipment manufacturers to discuss video surveillance system interface requirements.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Include plan views indicating locations of system components and proposed size, type, and routing of conduits and/or cables. Include elevations and details of proposed equipment arrangements. Include system interconnection schematic diagrams. Include requirements for interface with other systems.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.

- D. Design Data:
 - 1. Standby battery/UPS calculations.
 - 2. Video storage capacity calculations.
- E. Certify that proposed system design and components meet or exceed specified requirements.
- F. Evidence of qualifications for installer.
- G. Evidence of qualifications for maintenance contractor (if different entity from installer).
- H. Manufacturer's detailed field testing procedures.
- I. Project Record Documents: Record actual locations of system components and installed wiring arrangements and routing.
- J. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
 - 1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
- K. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- L. Maintenance contracts.
- M. Software: One copy of software not resident in read-only memory.

1.06 QUALITY ASSURANCE

- A. Comply with the following:
 - 1. NFPA 70.
 - 2. Applicable TIA/EIA standards.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with video surveillance systems of similar size, type, and complexity and providing contract maintenance service as a regular part of their business; authorized manufacturer's representative.
 - 1. Contract maintenance office located within 100 miles of project site.
- C. Maintenance Contractor Qualifications: Same entity as installer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NECA 303.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum three year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Video Recording and Viewing Equipment - Basis of Design: Avigilon ACC 7.
- B. Substitutions: See Section 016000 - Product Requirements.

- C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.
- D. Source Limitations: Where possible, furnish system components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 VIDEO SURVEILLANCE SYSTEM

- A. Provide new video surveillance system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. System Description: IP system with connection to network (IP) cameras.
 - 1. Video Storage Capacity: Suitable for storing video from all cameras for 90 days.
- C. Video Recording and Viewing Equipment Required:
 - 1. See article "VIDEO RECORDING AND VIEWING EQUIPMENT" below for product descriptions.
 - 2. Network Recorder Location - Demark:
 - a. Network Video Recorder (NVR): Three NVR5-PRM-288TB-S19-NA..
 - 1) Mouse and keyboard. One
 - 2) Monitor(s): One.
 - 3) Storage unit(s): 288TB NVR
 - 4) Mounting Equipment: Network rack(s)
 - 3. Monitoring Location - Security Office:
 - a. Monitoring Workstation Computer(s): One RM6-WKS-4MN-NA.
 - 1) Mouse and keyboard.
 - 2) Monitor(s): Four.
 - 3) Speakers (where not integral with monitor).
 - 4) Microphone.
 - 5) Controller: PTZ Joystick
- D. Interface with Other Systems:
 - 1. Provide products compatible with other systems requiring interface with video surveillance system.
 - 2. Interface with access control system as specified in Section 281000.
 - a. Capable of affecting camera/video operation for selected access control system events.
 - 3. Interface with intrusion detection system as specified in Section 283111.
 - a. Capable of affecting camera/video operation for selected intrusion detection system events.
 - b. Capable of affecting intrusion detection system status for selected video surveillance system events.
- E. Provide products listed, classified, and labeled as suitable for the purpose intended.
- F. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.03 VIDEO RECORDING AND VIEWING EQUIPMENT

- A. Provide video recording and viewing equipment compatible with cameras to be connected.
- B. Network Video Recorders (NVRs):
 - 1. Supports connection of network (IP) cameras.
 - 2. Supports continuous and event-based recording.
 - 3. Network Video Recorder R5-PRM-288TB-S19-NA:
 - a. Basis of Design: Avigilon NVR5 PRM 288TB 519 NA.
 - b. Recording and Viewing Performance: 30 fps at 5 MP to 12 MP resolution.

- c. Storage Capacity: 288 TB.
- d. Removable Media: USB.
- e. Network: 2 × 10 GbE SFP+ ports, 4 × 1 GbE RJ-45 ports..
- f. Features:
 - 1) Supports PTZ camera control.
 - 2) Supports remote access via desktop client, mobile device, and web client.
 - 3) Supports Appearance Search technology and advanced analytics.
 - 4) 5YR, 4HR, Mission Critical technical support and warranty
- C. Computers:
 - 1. Workstation Computers: Avigilon RM6-WKS-4MN-NA.
 - 2. Servers: Three NVR5-PRM-288TB-S19-NA.
- D. Software:
 - 1. Unless otherwise indicated, provide all software and licenses required for fully operational system.
 - 2. Video Management System:
 - a. Basis of Design: Avigilon ACC 7 Enterprise.
- E. Monitors:
 - 1. Unless otherwise indicated, monitors to be provided by Contractor as part of work of this section.
 - 2. Monitor: TFT active-matrix LCD.
 - a. Resolution: Up to 1280 x 1024 (SXGA).

2.04 CAMERAS

- A. Provide cameras and associated accessories suitable for operation under the service conditions at the installed location. Provide additional components (e.g. enclosures, heaters, blowers, etc.) as required.
- B. Where not factory-installed, provide additional components (e.g. lenses, mounting accessories, etc.) as necessary for complete installation.
- C. Network (IP) Cameras:
 - 1. Signal-to-Noise Ratio: Not less than 50 dB.
 - 2. Provide the following standard features:
 - a. Automatic electronic shutter.
 - b. Automatic gain control.
 - c. Automatic white balance.
 - d. Web-based interface for remote viewing and setup.
 - e. Password protected security access.
 - f. 5 year warranty.
 - g. NDAA, FAR, TAA adherence.
- D. Network (IP) Fixed Corner Camera: Indoor/ Outdoor Corner Cameras; Detention Cells
 - 1. Basis of Design: Avigilon H5A Series; Model 5.0C-H5A-CR2-IR INDOOR/OUTDOOR; <https://www.avigilon.com/products/cameras-sensors/h5a-cr>
 - a. Maximum Video Resolution: 5MP.
 - b. Maximum Frame Rate: 20/20; or 25/30 fps at 50/60 Hz.
 - c. Image Sensor Size: 1/2.8 inch CMOS.
 - d. Minimum Illumination/Light Sensitivity: 0.027 lux in color mode < 0.014 lux in monochrome mode, 0 lux with IR lux (color).
 - e. Lens: 2.3MM.
 - f. Features:
 - 1) Anti-ligature.
 - 2) No-grip and IK10+ impact-rated.
 - 3) FIPS 140-2 Compliant.
 - 4) H.264 HDSM SmartCodec.

- 5) H.265 HDSM SmartCodec.
 - 6) Motion JPEG.
 - 7) Advanced Analytics.
 - 8) Object Classification.
 - 9) 12-28 VDC and Power over Ethernet (PoE).
 - 10) Day and night functionality.
 - 11) Image rotation (0, 90, 180, or 270 degrees).
- E. Network (IP) Mini Dome Camera: Indoor Mini Dome Cameras
1. Basis of Design: Avigilon H6M Series; Model 5.0C-H6M-D1-IR INDOOR; and 5.0C-H6M-D2-IR INDOOR; <https://www.avigilon.com/products/cameras-sensors/h6m#overview>.
 2. Basis of Design: Avigilon H6M Series; Model 5.0C-H6M-D1-IR INDOOR; and 5.0C-H6M-D2-IR INDOOR; <https://www.avigilon.com/products/cameras-sensors/h6m#overview>.
 - a. Maximum Video Resolution: 5MP.
 - b. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
 - c. Image Sensor Size: 1/2.8 inch CMOS.
 - d. Minimum Illumination/Light Sensitivity: 0.01 lux in monochrome mode; 0.02 lux in color mode lux (color).
 - e. Lens: D1 2.95 mm; D2 2.4 mm.
 - f. Features:
 - 1) FIPS 140-2 Compliant.
 - 2) H.264 HDSM SmartCodec.
 - 3) H.265 HDSM SmartCodec.
 - 4) Motion JPEG.
 - 5) Pixel motion: Selectable sensitivity and threshold.
 - 6) Classified Object Detection.
 - 7) Motion Detection,.
 - 8) Power over Ethernet (PoE).
 - 9) Day and night functionality,.
 - 10) Image rotation (0, 90, 180, or 270 degrees).
- F. Network (IP) Fixed Bullet Camera: Outdoor Bullet Cameras
1. Basis of Design: Avigilon H5A Series; Model 8.0C-H5A-B01-IR (Outdoor, IR illumination); <https://www.avigilon.com/products/cameras-sensors/h5a>.
 - a. Maximum Video Resolution: 3840 x 2160.
 - b. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
 - c. Image Sensor Size: 1/1.8" progressive scan CMOS.
 - d. Minimum Illumination/Light Sensitivity (Color): 0.055 lux in color mode, 0.028 lux in monochrome mode, 0 lux with IR lux.
 - e. Lens: 4.9 – 8 MM, F1.8; horizontal field of view of (16:9) 52° – 92° degrees; varifocal, P-Iris, remote focus and zoom.
 - f. Features:
 - 1) FIPS 140-2 Compliant.
 - 2) H.264 HDSM SmartCodec.
 - 3) H.265 HDSM SmartCodec.
 - 4) Motion JPEG.
 - 5) Advanced Analytics.
 - 6) Object Classification.
 - 7) 12-28 VDC and Power over Ethernet (PoE).
 - 8) Day and night functionality.
 - 9) Image rotation (0, 90, 180, or 270 degrees).
- G. Network (IP) Fixed Outdoor Dome Camera: Fixed Outdoor Varifocal Cameras
1. Basis of Design: Avigilon H5A Series; Model 8.0C-H5A-DO1-IR (Outdoor, IR illumination); <https://www.avigilon.com/products/cameras-sensors/h5a>.

- a. Maximum Video Resolution: 3840 x 2160.
 - b. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
 - c. Image Sensor Size: 1/1.8" progressive scan CMOS.
 - d. Minimum Illumination/Light Sensitivity (Color): 0.055 lux in color mode, 0.028 lux in monochrome mode, 0 lux with IR lux.
 - e. Lens: 4.9 – 8 MM, F1.8; horizontal field of view of (16:9) 52 degrees – 92 degrees; varifocal, P-Iris, remote focus and zoom.
 - f. Features:
 - 1) FIPS 140-2 Compliant.
 - 2) H.264 HDSM SmartCodec.
 - 3) H.265 HDSM SmartCodec.
 - 4) Motion JPEG,.
 - 5) Advanced Analytics.
 - 6) Object Classification.
 - 7) 12-28 VDC and Power over Ethernet (PoE).
 - 8) day and night functionality.
 - 9) image rotation (0, 90, 180, or 270 degrees).
- H. Network (IP) Fixed Indoor Dome Camera: Indoor Dome Varifocal Cameras
1. Basis of Design: Avigilon H6SL Series; Model 5.0C-H6SL-D1-IR (Indoor, IR illumination); <https://www.avigilon.com/products/cameras-sensors/h6sl>.
 - a. Maximum Video Resolution: 2560 × 1440, 1920 × 1080, 2592 × 1944, 2240 × 1680.
 - b. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
 - c. Image Sensor Size: 1/2.8" progressive scan CMOS.
 - d. Minimum Illumination/Light Sensitivity (Color): With IR: 0 lux in monochrome mode
Without IR: 0.04 lux in color mode; 0.02 lux in monochrome mode lux.
 - e. Lens: 3.4-10.5 mm; horizontal field of view of 95 degrees - 28 degrees; varifocal, P-Iris, remote focus and zoom.
 - f. Features:
 - 1) FIPS 140-2 Compliant.
 - 2) H.264 HDSM SmartCodec
 - 3) H.265 HDSM SmartCodec.
 - 4) Motion JPEG.
 - 5) Advanced Analytics.
 - 6) Object Classification.
 - 7) 12-28 VDC and Power over Ethernet (PoE).
 - 8) day and night functionality.
 - 9) image rotation (0, 90, 180, or 270 degrees).
- I. 1. Network (IP) Pan Tilt Zoom Outdoor Dome Camera:
1. Basis of Design: Avigilon H5A-IR-PTZ Series; Model 8.0C-H5A-IRPTZ-DP36-WP (Outdoor, IR illumination, Wiper-blade); <https://www.avigilon.com/products/cameras-sensors/h5a-ir-ptz>
 2.
 - a. Maximum Video Resolution: 3840 x 2160 Active Pixels.
 - a. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
 - b. Image Sensor Size: 1/2.5 " Type "Exmor R" CMOS Sensor.
 - c. Minimum Illumination/Light Sensitivity (Color):
 - d. Lens: 4.4 mm to 88 mm, F/2.0 – F/3.8, autofocus; horizontal field of view of 69.7 degrees – 2.2 degrees; remote focus and zoom 36x (with image stabilization off), 30x (with image stabilization on).
 - e. Features:
 - 1) 36x zoom, Wiperblade,
 - 2) IR Illumination up to 150 meters,
 - 3) FIPS 140-2 Compliant,
 - 4) H.264 HDSM SmartCodec,

- 5) H.265 HDSM SmartCodec,
 - 6) Motion JPEG,
 - 7) Advanced Analytics,
 - 8) Object Classification,
 - 9) Power over Ethernet (PoE),
 - 10) Day and night functionality,
 - 11) Image rotation (0, 90, 180, or 270 degrees)
- J. Network (IP) Fixed Outdoor Dome Camera: Fisheye/Panoramic Cameras
1. - Basis of Design: Avigilon H5A Series; Model 12.0W-H5A-FE-DO1-IR (Surface mount, Indoor/Outdoor, IR illumination); <https://www.avigilon.com/products/cameras-sensors/h5a-fe>.
 - a. Maximum Video Resolution: 3008 x 3008 Active Pixels; 4.662 mm x 4.662 mm Imaging Area;.
 - b. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
 - c. Image Sensor Size: 1/2.3" progressive scan CMOS.
 - d. Minimum Illumination/Light Sensitivity (Color): 0 lux with IR, without IR 0.19 lux in monochrome mode; 0.38 lux in color mode lux.
 - e. Lens: 1.6 mm; horizontal field of view of 360° degrees; Fixes Iris, Autofocus.
 - f. Features:
 - 1) Dewarping,
 - 2) built-in microphone,
 - 3) FIPS 140-2 Compliant,
 - 4) H.264 HDSM SmartCodec,
 - 5) H.265 HDSM SmartCodec,
 - 6) Motion JPEG,
 - 7) Advanced Analytics,
 - 8) Object Classification,
 - 9) 12-28 VDC and Power over Ethernet (PoE),
 - 10) day and night functionality,
 - 11) image rotation (0, 90, 180, or 270 degrees).
- K. Network (IP) Fixed Outdoor Dome Camera: Duelhead dome varifocal cameras
1. Basis of Design: Avigilon H5A Series; Model 10.0C-H5DH-DO1-IR (Surface mount, Indoor/Outdoor, IR illumination); <https://www.avigilon.com/products/cameras-sensors/h5a-dual-head>.
 - a. Maximum Video Resolution: 2x Image Sensor 5184 x 1944.
 - b. Maximum Frame Rate: 24/20 fps at 50/60 Hz.
 - c. Image Sensor Size: 1/2.7" progressive scan CMOS.
 - d. Minimum Illumination/Light Sensitivity (Color): 0.1 lux in color mode, 0.05 lux in monochrome mode, 0 lux with IR on lux.
 - e. Lens: 3.35 - 7.0 mm, F/1.93; horizontal field of view of 43° – 91° degrees; varifocal, P-Iris, remote focus and zoom.
 - f. Features:
 - 1) FIPS 140-2 Compliant.
 - 2) H.264 HDSM SmartCodec.
 - 3) H.265 HDSM SmartCodec.
 - 4) Motion JPEG.
 - 5) Advanced Analytics.
 - 6) Object Classification.
 - 7) 12-28 VDC and Power over Ethernet (PoE).
 - 8) Day and night functionality.
 - 9) Image rotation (0, 90, 180, or 270 degrees).
- L. Network (IP) Fixed Outdoor Dome Camera: Video Intercom Camera

1. Basis of Design: Avigilon H5A Series; Model 3.0C-H4VI-RO1-IR (Recessed mount, Outdoor, IR illumination); <https://www.avigilon.com/products/cameras-sensors/h4-video-intercom>.
 - a. Maximum Video Resolution: 2048 x 1536.
 - b. Maximum Frame Rate: 25/30 fps at 50/60 Hz.
 - c. Image Sensor Size: 1/2.8 inch(es) Progressive Scan CMOS.
 - d. Minimum Illumination/Light Sensitivity (Color): With IR 0 lux, Without IR 0.14 lux (F2.4) in color mode; 0.03 lux (F2.4) in monochrome mode lux.
 - e. Lens: 1.83mm, F2.4; field of view of (H x v) 170° x 120° degrees; IR Corrected, Fixed Iris, remote focus.
 - f. Features:
 - 1) Built-in Microphone,
 - 2) Access Control Integration,
 - 3) H.264 HDSM SmartCodec,
 - 4) H.265 HDSM SmartCodec,
 - 5) Motion JPEG,
 - 6) Advanced Analytics,
 - 7) Object Classification,
 - 8) 12-28 VDC and Power over Ethernet (PoE),
 - 9) Day and night functionality,
 - 10) Image rotation (0, 90, 180, or 270 degrees).

2.05 ACCESSORIES

- A. Camera Enclosures: Where not factory-installed, provide camera enclosures suitable for operation under service conditions at installed location.
- B. Camera Mounting Supports: Where not factory installed, provide mounting supports necessary for installation.
 1. Products:
 - a. StrongPoles, LLC; HD Parapet Camera Mount: www.strongpoles.com/#sle.
 - b. StrongPoles, LLC; Parapet Mount: www.strongpoles.com/#sle.
- C. Provide components as indicated or as required for connection of video surveillance system to devices and other systems indicated.
- D. Provide components as indicated or as required for system power and network connections.
- E. Provide accessory controllers as indicated or as required for operator control.
- F. Provide cables as indicated or as required for connections between system components.
 1. Data Cables for IP Network Connections: Unshielded twisted pair (UTP), minimum Category 5e, complying with Section 271000.
- G. Provide accessory racks/cabinets as indicated or as required for equipment mounting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system where applicable.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install video surveillance system in accordance with NECA 1 (general workmanship) and NECA 303.
- B. Install products in accordance with manufacturer's instructions.
- C. Provide required support and attachment in accordance with Section 260529.
- D. Wiring Method: Unless otherwise indicated, use cables (not in conduit).
 - 1. Use suitable listed cables in wet locations, including underground raceways.
 - 2. Use suitable listed cables for vertical riser applications.
 - 3. Use listed plenum rated cables in spaces used for environmental air.
 - 4. Conceal all cables unless specifically indicated to be exposed.
 - 5. Route exposed cables parallel or perpendicular to building structural members and surfaces.
- E. Provide grounding and bonding in accordance with Section 260526.
- F. Identify system wiring and components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
- C. Prepare and start system in accordance with manufacturer's instructions.
- D. Adjust cameras to provide desired field of view and produce suitable images under all service lighting conditions.
- E. Program system parameters according to requirements of Owner.
- F. Test for proper interface with other systems.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

- A. See Section 017900 - Demonstration and Training, for additional requirements.

3.06 PROTECTION

- A. Protect installed system components from subsequent construction operations.

3.07 MAINTENANCE

- A. Provide to Owner, a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of video surveillance system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

3.08 VIDEO SURVEILLANCE EQUIPMENT

- A. Video Surveillance Equipment Cutshets are appended to this section.

END OF SECTION 282100

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SECTION 283100
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Notification appliances.
 - 5. Remote annunciator.
 - 6. Addressable interface device.
 - 7. Digital alarm communicator transmitter.
- B. Related Requirements:
 - 1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
- B. Shop Drawings: For fire-alarm system.
 - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - 2. Include plans, elevations, sections, details, and attachments to other work.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 - 4. Detail assembly and support requirements.
 - 5. Include voltage drop calculations for notification-appliance circuits.
 - 6. Include battery-size calculations.
 - 7. Include input/output matrix.
 - 8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
 - 9. Include performance parameters and installation details for each detector.
 - 10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Locate detectors according to manufacturer's written recommendations.
 - 12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
- C. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 - 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level III minimum.
 - c. Licensed or certified by authorities (State or Local) having jurisdiction.

- D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
 - 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
 - 3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.03 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
- C. Field quality-control reports.
- D. Sample warranty.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment.
 - d. Riser diagram.
 - e. Record copy of site-specific software.
 - f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
 - g. Manufacturer's required maintenance related to system warranty requirements.
 - h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II or higher technician.

- C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.06 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- B. Automatic sensitivity control of certain smoke detectors.
- C. All components provided shall be listed for use with the selected system.
- D. 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.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
1. Manual stations.
 2. Smoke detectors.
 3. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances.
 2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 8. Recall elevators to primary or alternate recall floors.
 9. Record events in the system memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
 2. Duct mounted smoke detectors.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
 4. Loss of primary power at fire-alarm control unit.
 5. Ground or a single break in internal circuits of fire-alarm control unit.
 6. Abnormal ac voltage at fire-alarm control unit.
 7. Break in standby battery circuitry.
 8. Failure of battery charging.
 9. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Supervisory Signal Actions:
1. Identify specific device initiating the event at fire-alarm control unit and remote annunciators .

2. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.

2.03 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.04 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
 1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
 2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
 1. Pathway Class Designations: NFPA 72, Class B.
 2. Pathway Survivability: Level 0.
- D. Notification-Appliance Circuit:
 1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
 2. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- E. Elevator Recall:
 1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoist way.
 2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
- F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.
- G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.
- H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals,

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

2.05 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.
 1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key- or wrench-operated switch.

2.06 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Detectors shall be two-wire type.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
- B. Photoelectric Smoke Detectors:
 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
 4. Each sensor shall have multiple levels of detection sensitivity.
 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
 6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

2.07 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464.
- C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 1. Mounting: Wall or ceiling mounted.
 2. Flashing shall be in a temporal pattern, synchronized with other units.
 3. Strobe Leads: Factory connected to screw terminals.
 4. Mounting Faceplate: Factory finished, white.

2.08 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 3. Rating: 24-V ac or dc.
 4. Rating: 120-V ac.
- B. Material and Finish: Match door hardware.

2.09 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. General:
 1. Include address-setting means on the module.
 2. Store an internal identifying code for control panel use to identify the module type.
 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Control Module:
 1. Operate notification devices.
 2. Other protected premise fire safety functions present.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically transmit alarms to remote central station via cellular communication pathways. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of communication to the remote alarm receiving station over the remaining pathway. Transmitter shall automatically report communication pathway restoration to the central station. If service is lost on both communication pathways, transmitter shall initiate the local trouble signal.

- C. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.
 - 4. Loss of ac supply.
 - 5. Loss of power.
 - 6. Low battery.
 - 7. Abnormal test signal.
 - 8. Communication bus failure.
- D. Secondary Power: Integral rechargeable battery and automatic charger.
- E. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 EXECUTION

3.01 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
- C. Equipment Mounting: Install fire-alarm control unit on wall.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- F. Smoke Detector Spacing: Comply with NFPA 72.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.
- H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- I. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

3.02 PATHWAYS

- A. Pathways above recessed ceilings and in inaccessible locations may be routed exposed.
 - 1. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.

- B. Pathways shall be installed in EMT.
- C. Exposed EMT shall be painted red enamel.

3.03 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Smoke dampers in air ducts of designated HVAC duct systems.
 - 2. Magnetically held-open doors.
 - 3. Electronically locked doors and access gates.
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Supervisory connections at valve supervisory switches.

3.04 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.05 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.06 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by local Fire Department.
- B. Perform the following tests and inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

- C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.07 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.08 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283100

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**SECTION 283111
BUILDING INTRUSION DETECTION**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Intrusion detection system requirements.
- B. Initiating devices.
- C. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 281000 - Access Control: For interface with intrusion detection system.
- D. Section 282100 - Video Surveillance Cameras: For interface with intrusion detection system.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 609 - Local Burglar Alarm Units and Systems Current Edition, Including All Revisions.
- D. UL 634 - Connectors and Switches for Use with Burglar-Alarm Systems Current Edition, Including All Revisions.
- E. UL 636 - Holdup Alarm Units and Systems Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate compatibility of devices for the installed locations with work provided under other sections or by others.
 - 2. Coordinate the placement of sensors and keypads with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install sensors and keypads until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each system component. Include ratings, configurations, standard wiring diagrams, dimensions, finishes, service condition requirements, and installed features.
- C. Certify that proposed system design and components meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.
- B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 INTRUSION DETECTION SYSTEM REQUIREMENTS

- A. Provide modifications and extensions to existing intrusion detection system consisting of all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.
- B. Alarm Control Unit: New addressable alarm control panel located as coordinated with owner.
- C. Initiating Device Requirements:
 - 1. Provide panic button at locations indicated on drawings (PB).
- D. Alarm Notification and Reporting Requirements:
 - 1. Activate alarm notification at alarm control unit and associated keypads/annunciators with appropriate zone information displayed.
- E. Interface with Other Systems:
 - 1. Provide products compatible with other systems requiring interface with intrusion detection system.
 - 2. Interface with access control system as specified in Section 281000.
 - 3. Interface with video surveillance system as specified in Section 282100.
- F. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 1. Local Alarm Units and Systems: Listed and labeled as complying with UL 609.
- G. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B, consumer application.

2.02 INITIATING DEVICES

- A. Manufacturers: Same as manufacturer of alarm control units where possible.
- B. General Requirements:
 - 1. Provide devices suitable for intended application and location to be installed.
 - 2. Wireless Devices:
 - a. Reports sensor status to control panel via self-contained or separate accessory wireless transmitter.
 - b. Sends periodic check-in signals to control panel for reporting of missing devices.
 - c. Reports low battery condition before its battery becomes too discharged to power the transmitter.
 - d. Provide tamper protection.
- C. Panic Switches:
 - 1. Listed and labeled as complying with UL 634 or UL 636 as applicable.
 - 2. Hold-Up/Panic Buttons: Manual push button operation.

2.03 ACCESSORIES

- A. Provide components as indicated or as required for connection of alarm control unit to devices and other systems indicated.
- B. Provide wireless receivers and repeaters as indicated or as required for communication between wireless devices and alarm control unit; provide tamper protection.

- C. Provide cables as indicated or as required for connections between system components.
- D. Provide end-of-line resistors (EOLR) as required for supervision of hardwired zones.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of system components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive system components.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to system.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Provide grounding and bonding in accordance with Section 260526.
- D. Identify system wiring and components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Prepare and start system in accordance with manufacturer's instructions.
- C. Inspection and testing to include, at a minimum:
 - 1. Test each initiating device for proper response by alarm control unit.
 - 2. Test for proper operation of output relays.
 - 3. Test for proper interface with other systems.
- D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.04 ADJUSTING

- A. Program system parameters according to requirements of Owner.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 017900 - Demonstration and Training, for additional requirements.
- B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

3.07 PROTECTION

- A. Protect installed system components from subsequent construction operations.

END OF SECTION 283111

**SECTION 310000
EARTHWORK**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General Conditions for Earthwork.
- B. Earthwork.
- C. Trenching.

1.02 REFERENCE STANDARDS

- A. COTF Rev ISPWC - City of Twin Falls Revisions to the 2017 Idaho Standards for Public Works Construction 2019.
- B. ISPWC - Idaho Standards for Public Works Construction 2020.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Comply with Reference Standards requirements for any submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL

- A. Conform to the current adopted version of the Idaho Standards for Public Works Construction (ISPWC), and the City of Twin Falls Revisions to the 2017 Idaho Standards for Public Works Construction.(COTF Rev ISPWC.)

END OF SECTION 310000

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**SECTION 323113
CHAIN LINK FENCES AND GATES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Posts, rails, and frames.
- B. Wire fabric.
- C. Barbed wire.
- D. Concrete.
- E. Manual gates with related hardware.
- F. Accessories.

1.02 REFERENCE STANDARDS

- A. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire 2022.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- E. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2022a.
- F. ASTM F567 - Standard Practice for Installation of Chain-Link Fence 2014a (Reapproved 2019).
- G. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework 2018 (Reapproved 2022).
- H. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures 2018 (Reapproved 2022).
- I. CLFMI CLF-FIG0111 - Field Inspection Guide 2014.
- J. CLFMI CLF-PM0610 - Product Manual 2017.
- K. CLFMI CLF-SFR0111 - Security Fencing Recommendations 2014.
- L. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric) 1990.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.

1.04 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Chain Link Fences and Gates:
 - 1. Master-Halco, Inc: www.masterhalco.com/#sle.
 - 2. Merchants Metals: www.merchantsmetals.com/#sle.

2.02 COMPONENTS

- A. Line Posts: 1.9 inch diameter.
- B. Corner and Terminal Posts: 2.38 inch diameter.
- C. Gate Posts: 3-1/2 inch diameter.
- D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
- E. Bottom Rail: 1.66 inch diameter, plain end, sleeve coupled.
- F. Gate Frame: 1.66 inch diameter for welded fabrication.
- G. Fabric: 2 inch diamond mesh interwoven wire, 6 gauge, 0.1920 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.
- H. Tension Wire: 6 gauge, 0.1920 inch thick steel, single strand.
- I. Tie Wire: Aluminum alloy steel wire.

2.03 MATERIALS

- A. Posts, Rails, and Frames:
 - 1. ASTM A1011/A1011M, Designation SS; hot-rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum yield strength of 50 ksi; zinc coating complying with ASTM F1043 and ASTM F1083.
 - 2. Line Posts: Type I round in accordance with FS RR-F-191/1D.
 - 3. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.
 - 4. Comply with CLFMI CLF-PM0610.
- B. Wire Fabric:
 - 1. Comply with CLFMI CLF-PM0610.
- C. Barbed Wire:
 - 1. Zinc-coated steel, complying with ASTM A121 Type Z Coating Class 1; 2 strands of 0.099 inch diameter wire, with 2-pointed barbs at 4 inches on center.
- D. Concrete:
 - 1. Ready-mixed, complying with ASTM C94/C94M; normal Portland cement; 2,500 psi strength at 28 days, 3 inch slump; 3/8 inch nominal size aggregate.

2.04 MANUAL GATES AND RELATED HARDWARE

- A. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.
- B. Hinges: Finished to match fence components.
 - 1. Brackets: Round.
 - 2. Closing: Manual.
- C. Latches: Finished to match fence components.
 - 1. Brackets: Round.

2.05 LIGHT-DUTY ARCHITECTURAL HARDWARE

- A. Hinge Set: Self-closing, for top and bottom support of swinging gate.
 - 1. Swing Direction: One way.
 - 2. Mounting to Round Fence Post and Gate Frame: Integral clamp.
 - 3. Finish: Galvanized.

2.06 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.

- C. Extension Arms: Cast steel galvanized, to accommodate 3 strands of barbed wire, single arm, vertical.

2.07 FINISHES

- A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 ounces per square foot.
- B. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.
- C. Accessories: Same finish as framing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

3.02 PREPARATION

- A. Removal: Obstructions or debris.

3.03 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Place fabric on outside of posts and rails.
- C. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
- D. Line Post Footing Depth Below Finish Grade: ASTM F567.
- E. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.
- F. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.
- G. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
- H. Do not stretch fabric until concrete foundation has cured 28 days.
- I. Stretch fabric between terminal posts or at intervals of 100 feet maximum, whichever is less.
- J. Position bottom of fabric 2 inches above finished grade.
- K. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- L. Install bottom tension wire stretched taut between terminal posts.
- M. Do not attach the hinged side of gate to building wall; provide gate posts.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Position: 1 inch.
- C. Do not infringe on adjacent property lines.

3.05 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- C. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.
- D. Barbed Wire: Randomly inspect three locations against design for:
 - 1. Spacing of barb wire.
 - 2. Diameter of loops.
 - 3. Quantity of loops per length of fence.
- E. Gates: Inspect for level, plumb, and alignment.

- F. Workmanship: Verify neat installation free of defects. See CLFMI CLF-FIG0111 for field inspection guidance.

3.06 CLEANING

- A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

END OF SECTION 323113

**SECTION 323300
SITE FURNISHINGS**

PART 2 PRODUCTS

1.01 BOLLARDS

- A. Stainless Steel Pipe Bollards: Hollow steel pipe, plain shaft, brushed finish.

END OF SECTION 323300

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**SECTION 328423
UNDERGROUND SPRINKLERS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe and fittings, valves, sprinkler heads, dripline, and accessories.

1.02 REFERENCE STANDARDS

- A. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings 2022.
- B. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series) 2020.
- C. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

1.03 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with site backfilling, landscape grading and delivery of plant life.

1.04 SUBMITTALS

- A. Product Data: Provide component and control system and wiring diagrams.
- B. Shop Drawings: Indicate piping layout to water source, location of sleeves under pavement, location and coverage of sprinkler heads, components, plant and landscaping features, site structures, schedule of fittings to be used.
- C. Operation and Maintenance Data:
 - 1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
 - 2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.
- D. Record Documents: Record actual locations of all concealed components piping system.
- E. Maintenance Materials: Provide the following for Owner's use in maintenance of project.
 - 1. Extra Sprinkler Heads: One of each type and size.
 - 2. Extra Valve Keys for Manual Valves: One.
 - 3. Extra Valve Box Keys: One.
 - 4. Extra Valve Marker Keys: One.
 - 5. Wrenches: One for each type head core and for removing and installing each type head.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with applicable code for piping and component requirements.

2.02 PIPE MATERIALS

- A. PVC Pipe: ASTM D2241; 200 psi pressure rated upstream from controls, 160 psi downstream; solvent welded sockets.
- B. Fittings: Type and style of connection to match pipe.
- C. Solvent Cement: ASTM D2564 for PVC pipe and fittings.
- D. Sleeve Material: PVC.

2.03 OUTLETS

- A. Manufacturers:
 - 1. As indicated on the drawings..

2.04 VALVES

- A. Manufacturers:
 - 1. As indicated on the drawings..
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.05 CONTROLS

- A. Manufacturers:
 - 1. As indicated on the drawings..

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify location of existing utilities.
- B. Verify that required utilities are available, in proper location, and ready for use.

3.02 PREPARATION

- A. Piping layout indicated is diagrammatic only. Route piping to avoid plants, ground cover, and structures.
- B. Layout and stake locations of system components.
- C. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

3.03 TRENCHING

- A. Maintain trenches free of debris, material, or obstructions that may damage pipe.

3.04 INSTALLATION

- A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.
- B. Connect to utilities.
- C. Set outlets and box covers at finish grade elevations.
- D. Provide for thermal movement of components in system.
- E. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

END OF SECTION 328423

**SECTION 329223
SODDING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Fertilizing.
- D. Sod installation.
- E. Maintenance.

1.02 DEFINITIONS

- A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.03 REFERENCE STANDARDS

- A. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding 2006.

1.04 QUALITY ASSURANCE

- A. Sod Producer: Company specializing in sod production and harvesting with minimum five years experience, and certified by the State of Idaho.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sod on pallets. Protect exposed roots from dehydration.
- B. Do not deliver more sod than can be laid within 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of fertilizer and herbicide mixture.

2.02 MATERIALS

- A. Sod: TPI (SPEC), Certified Turfgrass Sod quality; cultivated grass sod; type indicated in plant schedule on Drawings; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq ft. Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
 - 1. Cut sod in area not exceeding 1 sq yd.
 - 2. Machine cut sod and load on pallets in accordance with TPI (SPEC) Guidelines.
- B. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay, or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

2.03 SOURCE QUALITY CONTROL

- A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- B. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

- C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.

3.02 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after smooth raking of topsoil and prior to installation of sod.
- C. Apply fertilizer no more than 48 hours before laying sod.
- D. Mix thoroughly into upper 2 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.03 LAYING SOD

- A. Moisten prepared surface immediately prior to laying sod.
- B. Lay sod immediately after delivery to site to prevent deterioration.
- C. Lay sod smooth and tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.
- D. Where new sod adjoins existing grass areas, align top surfaces.
- E. Where sod is placed adjacent to hard surfaces, such as curbs, pavements, etc., place top elevation of sod 1/2 inch below top of hard surface.
- F. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.
- G. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

3.04 MAINTENANCE

- A. Provide maintenance at no extra cost to Owner; Owner will pay for water.
- B. Maintain sodded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.
- C. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
- D. Neatly trim edges and hand clip where necessary.
- E. Immediately remove clippings after mowing and trimming.
- F. Water to prevent grass and soil from drying out.
- G. Roll surface to remove irregularities.
- H. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- I. Immediately replace sod to areas that show deterioration or bare spots.
- J. Protect sodded areas with warning signs during maintenance period.

END OF SECTION 329223

**SECTION 329300
PLANTS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Topsoil bedding.
- C. New trees, plants, and ground cover.
- D. Mulch and Fertilizer.
- E. Maintenance.

1.02 DEFINITIONS

- A. Weeds: Any plant life not specified or scheduled.
- B. Plants: Living trees, plants, and ground cover specified in this Section , and described in ANSI Z60.1.

1.03 REFERENCE STANDARDS

- A. ANSI/AHIA Z60.1 - American National Standard for Nursery Stock 2014.
- B. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning) 2017.

1.04 SUBMITTALS

- A. Certificate: Certify fertilizer and herbicide mixture approval by authority having jurisdiction.
- B. Certificate: Submit certificate for plants free of disease or hazardous insects; certified by federal department of agriculture; free of disease or hazardous insects.

1.05 QUALITY ASSURANCE

- A. Nursery Qualifications: Company specializing in growing and cultivating the plants with three years documented experience.
- B. Maintenance Services: Performed by installer.
- C. Non-native, Invasive Plant Species: Do not introduce, grow, or cultivate plant species that are non-native to the ecosystem of the project site, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
 - 1. Comply with laws regulating non-native and invasive plant species in Idaho.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- B. Protect and maintain plant life until planted.
- C. Deliver plant life materials immediately prior to placement. Keep plants moist.

1.07 FIELD CONDITIONS

- A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F.
- B. Do not install plant life when wind velocity exceeds 30 mph.

1.08 WARRANTY

- A. Provide one year warranty.
- B. Warranty: Include coverage for one continuous growing season; replace dead or unhealthy plants.
- C. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of plants, fertilizer and herbicide mixture.
- C. Plant Materials: Certified by federal department of agriculture; free of disease or hazardous insects.

2.02 PLANTS

- A. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.

2.03 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; minimum pH value of 5.4 and maximum 7.0.

2.04 SOIL AMENDMENT MATERIALS

- A. Fertilizer: Containing fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.
- B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.
- C. Bone Meal: Raw, finely ground, commercial grade, minimum of 3 percent nitrogen and 20 percent phosphorous.
- D. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.
- E. Water: Clean, fresh, and free of substances or matter that could inhibit vigorous growth of plants.

2.05 TOP SOIL MIX

- A. A uniform mixture of 1 part peat and 3 parts topsoil by volume.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared subsoil and planters are ready to receive work.
- B. Saturate soil with water to test drainage.
- C. Verify that required underground utilities are available, in proper location, and ready for use.

3.02 PREPARATION OF SUBSOIL

- A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.
- C. Scarify subsoil to a depth of 3 inches where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.
- D. Dig pits and beds 6 inches larger than plant root system.

3.03 PLACING TOPSOIL

- A. Spread topsoil to a minimum depth indicated on the drawings over area to be planted. Rake smooth.
- B. Place topsoil during dry weather and on dry unfrozen subgrade.

- C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.
- D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.
- E. Install topsoil into pits and beds intended for plant root balls, to a minimum thickness of 6 inches.

3.04 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into upper 2 inches of topsoil.
- D. Lightly water to aid the dissipation of fertilizer.

3.05 PLANTING

- A. Place plants for best appearance.
- B. Set plants vertical.
- C. Remove non-biodegradable root containers.
- D. Set plants in pits or beds, partly filled with prepared plant mix, at a minimum depth of 6 inches under each plant. Remove burlap, ropes, and wires, from the root ball.
- E. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6 inch layers. Maintain plant life in vertical position.
- F. Saturate soil with water when the pit or bed is half full of topsoil and again when full.

3.06 FIELD QUALITY CONTROL

- A. Plants will be rejected if a ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

3.07 MAINTENANCE

- A. Provide maintenance at no extra cost to Owner; Owner will pay for water.
- B. Maintain plant life for three months after Date of Substantial Completion.
- C. Irrigate sufficiently to saturate root system and prevent soil from drying out.
- D. Remove dead or broken branches and treat pruned areas or other wounds.
- E. Neatly trim plants where necessary.
- F. Immediately remove clippings after trimming.
- G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
- H. Control insect damage and disease. Apply pesticides in accordance with manufacturers instructions.
- I. Remedy damage from use of herbicides and pesticides.
- J. Replace mulch when deteriorated.
- K. Maintain wrappings, guys, turnbuckles, and stakes. Adjust turnbuckles to keep guy wires tight. Repair or replace accessories when required.

END OF SECTION 329300